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RUNOFF VOLUME-DURATION-PROBABILITY ANALYSES  
for  
SELECTED WATERSHEDS  
in  
KENTUCKY

Prepared by the Central Technical Unit  
Hydrology Branch, Soil Conservation Service  
United States Department of Agriculture  
(FOR IN-SERVICE USE ONLY)

January 1966

### Acknowledgment

This report was prepared by the Central Technical Unit, Hydrology Branch, Engineering Division, SCS for in-Service use only. The high flow summaries used for the computations were prepared and furnished by the U.S. Geological Survey under a cooperative agreement.

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# RUNOFF VOLUME-DURATION-PROBABILITY ANALYSES

for

## SELECTED WATERSHEDS

### INTRODUCTION

The volume-duration-probability (VDP) analyses relate the annual maximum 1, 3, 7, 15, 30, 60, 90, 120, 183, and 274-day streamflow from selected watersheds to a percent chance. The annual maximum streamflow data for the various durations were furnished to the SCS by the U.S. Geological Survey through a Memorandum of Understanding initiated in 1961. The Central Technical Unit, through electronic data processing (EDP), estimated the probability of the annual maximum volumes for each duration.

The main use for these analyses is to determine the proper balance between detention storage and principal spillway capacity which will pass floods through floodwater retarding structures without using the emergency spillway, on the average, more frequently than specified in SCS standards. It was initiated to assist in complying with criteria set forth in Engineering Memorandum-27 (Rev.).

The computed output data are presented in tabular form, including certain statistics which were part of the analyses, and in graphical form with the high flow runoff volume in inches plotted at each of the durations analyzed. Each graph presents this relationship for the 1 and 4 percent probabilities which are those most commonly used in the design of floodwater retarding storage. The probable maximum runoff volume in inches (for convenience indicated as 0.0 percent chance) and the 50 percent chance are also shown in contrast with the two commonly used.

Data furnished by U. S. Geological Survey

As previously mentioned, the USGS provided the annual (water year) high flow volumes for the 1, 3, 7, 15, 30, 60, 90, 120, 183 and 270 day durations for those stream gage records requested by CTU. In preparing the request for data, CTU examined published stream gage records and selected stations in accordance with the following general provisions:

1. Drainage areas were less than 1000 square miles with a few exceptions.
2. Stations were omitted which were known to have had excessive diversion or stream regulation above the gage.
3. Station records which were obviously too short to reflect a reasonable estimate were omitted.

The CTU also examined the raw input data received from USGS to establish the period of record to be analyzed. In some cases a portion of the total period of record was excluded. Diversions or other regulatory structures have been installed above some stations in recent years. Those years in which the streamflow has been regulated have been omitted from the station analysis. Such exceptions are noted under "Period of Record" or "Remarks" in the following summaries. Furthermore, a base period of record has been extracted from the total record, representing a period common to a majority of the stations for comparison. Thus the common base period is being analyzed on as many stations as practical to permit a regional analysis of stations for most any choice of grouping.

Outliers

An outlier as considered here is an event which is probably foreign to the sample being analyzed. It is assumed that in a longer period of record the event might not be designated (identified) as an outlier. It is something which is not always known for certain. The remarks on each station tabulation identifies the durations and years for which the data were judged to be outliers.

An abbreviated method for inspecting the ordered data for outliers was used for these analyses. The upper and lower portions of the curves were inspected for one or more of the ordered values. Usually, the one day was plotted for all computed and observed values in order to check the fit of the computed curve to the observed data. When this fit was questionable, other durations were plotted for comparison of trend within the family of 10 curves.

Logarithmic Normal, No. 31,376, Codex Book Company probability paper was utilized for summarizing the data, except where the above graphs indicated

the data belonged to the Log Extreme Value or other distributions. A review of the station record and the date of the outlier event will often reveal the circumstances which support a conclusion of why it is nonrepresentative of the sample.

### Zero Probability

The volume for "zero probability" in the tables and charts is not the maximum probable volume. The probability distributions are truncated at selected reduced-variate values in published U-value tables. The Central Technical Unit used U-value "Tables of the Incomplete  $\Gamma$ -function" by Karl Pearson<sup>1</sup> for the zero probability in the analyses. The maximum reduced-variate value for the Pearson tables is approximately 5.250.

### Computer Analyses

The analyses are made possible through the utilization of electronic data processing. The CTU used a program described in FAP for IBM 7090 equipment for processing the data. It performs all the statistical computations required for obtaining the maximum annual volume of flow at each selected percent chance for 10 durations ranging from 1 through 274-days.

The Two-Parameter Gamma distribution applied to most of the cases in computing the 0-99 percent chance events. Otherwise the Log Normal distribution was used for those cases in which the gamma statistic was greater than 51.

The data and computed events have been plotted on log normal probability paper. The Gamma distribution plots as a concave downward curve. As the gamma statistic increases the curve approaches a straight line and a Log Normal distribution.

The computer input and output are on file in the CTU office. The file data includes, in addition to that shown in the following tabulations:

1. Original input ordered data in cfs per day and identified by the year of occurrence.
2. Logarithms to base 10 of each item of the input data.

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1/ H. M. Stationery Office, London, 1922.

### Effect of Durations Restricted Within a Fixed Year and Day

The high flow input data supplied by USGS establish the maximum runoff periods on (1) a water year basis and (2) on a calendar day basis. Although it isn't practical to analyze the data in any other way than by using a fixed period for a year, such as the water year from October 1 through September 30, greater volumes would likely show up for the longer (274-, 183-day, etc.) durations if beginning and ending dates could be chosen at will for the maximum period. For example a greater 274-day volume may have occurred between July 1, 1963 and March 30, 1964 than any 274-day period eligible for selection within either the 1963 or 1964 water year.

For this reason the following summaries show a lesser amount for the longer durations, being confined to the water year, than that which might actually be experienced for any unrestricted period.

In somewhat the same manner the volumes for the 1-day duration are confined to 24 hours in a fixed clock period. In many cases a greater 24-hour volume would overlap into the daily fixed period from either the previous or the subsequent day. The 3-day, 7-day, etc. may be similarly affected but to a much lesser and rapidly diminishing degree.

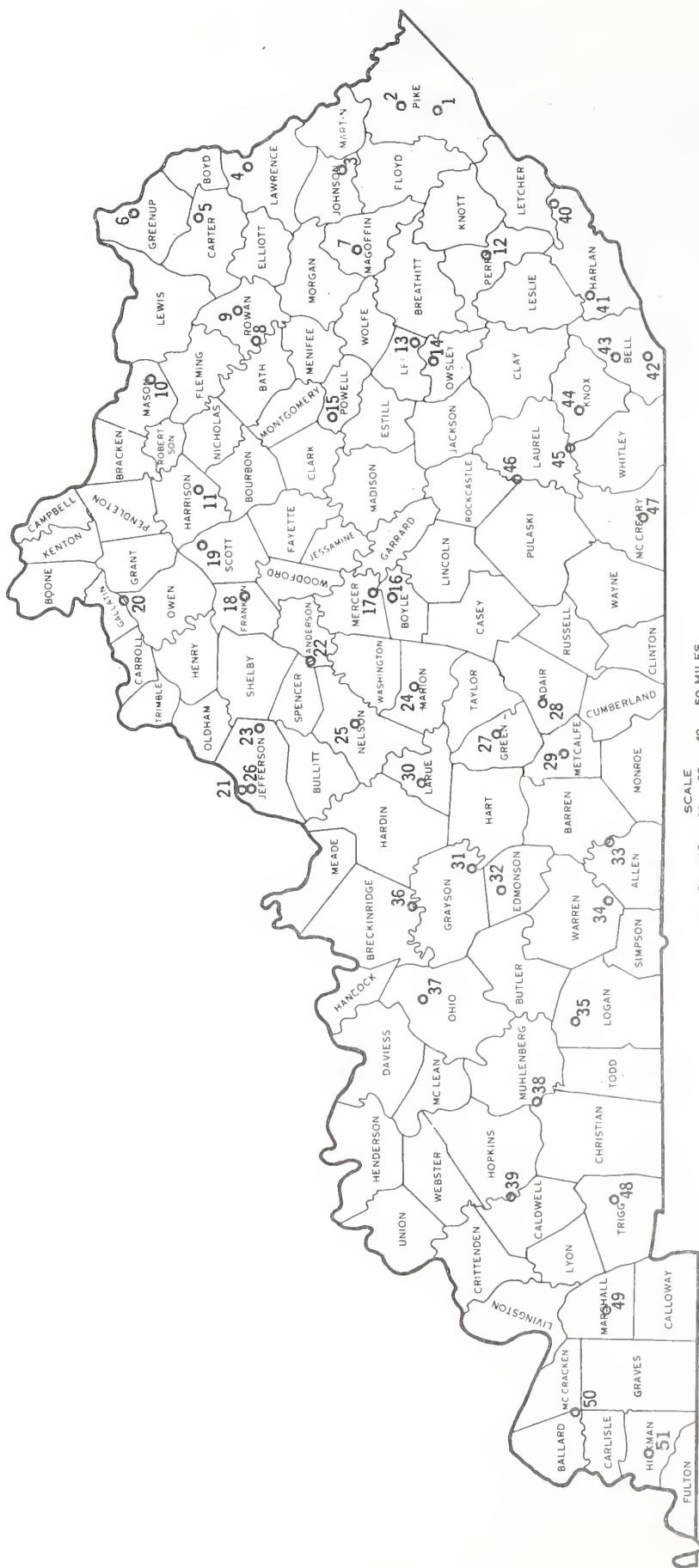
### Effect of Watershed Size

The range in watershed size, from a few square miles to about 1000 square miles, prevents a direct comparison of volumes of flow. The 1-day volume summary for a 1000 square mile watershed is comparatively smaller than that for a 5 square mile watershed because of difference in runoff lag time between them. Only a fraction of the 1-day runoff from the smaller watershed is contained in the 1-day measured runoff for its larger, 1000 square mile counterpart. Its volume may be distributed between and contained as a portion of several consecutive daily measurements. The greater prevalence of partial storm coverage over the larger watersheds further complicates a comparison of volume between them. Until sometime in the distant future when adequate data are available for small watersheds, empirical methods will continue to be required to transpose the measured results from large watersheds into the existing void of the small ones and for the most part are necessary in using the following summaries to plan and design small upstream water control structures.

Scope of Application

As stated in the introduction, the high flow tabulations are primarily for determining or authenticating other methods of determining the proper balance between detention storage and principal spillway capacities on flood water retarding structures. Their derivation from high flow input data almost restricts them to this primary use. Low flow and flow duration data were developed concurrently by USGS on these same stations in providing SCS with high flow data, and can be analyzed similarly to the VDP analysis to determine the probability of yield, sustained flows, etc.

# KENTUCKY



Central Technical Unit Number and Location of Stream Gages Included  
in Volume - Duration - Probability Analyses



# INDEX OF SELECTED STATIONS IN KENTUCKY

CTU No.	USGS No.	Drainage Area Sq. Mi.	Location of Stream Gage
1	03-2080.00	386.0	Levisa Fork at Fishtrap
2	03-2100.00	55.7	Johns Creek near Meta
3	03-2115.00	208.0	Johns Creek near Van Lear
4	03-2155.00	217.0	Blaine Creek at Yatesville
5	03-2165.00	398.0	Little Sandy R. near Grayson
6	03-2170.00	241.0	Tygarts Creek near Greenup
7	03-2485.00	140.0	Licking R. near Salyersville
8	03-2495.00	826.0	Licking R. at Farmers
9	03-2500.00	47.5	Triplett Creek at Morehead
10	03-2510.00	118.0	N. Fk. Licking R. nr. Lewisburg
11	03-2525.00	615.0	S. Fk. Licking R. at Cynthiana
12	03-2775.00	466.0	N. Fk. Kentucky R. at Hazard
13	03-2810.00	537.0	M. Fk. Kentucky R. at Tallega
14	03-2815.00	722.0	S. Fk. Kentucky R. at Booneville
15	03-2835.00	362.0	Red River at Clay City
16	03-2850.00	318.0	Dix River near Danville
17	03-2855.00	395.0	Dix River near Burgin
18	03-2895.00	473.0	Elkhorn Creek near Frankfort
19	03-2910.00	42.9	Big Eagle Cr. at Sadieville
20	03-2915.00	437.0	Eagle Creek at Glencoe
21	03-2925.00	18.8	S. Fk. Beargrass Cr. at Louisville
22	03-2955.00	200.0	Salt River near Van Buren
23	03-2980.00	138.0	Floyds Fork at Fisherville
24	03-2990.00	240.0	Rolling Fork near Lebanon
25	03-3010.00	664.0	Beach Fork at Bardstown
26	03-3020.00	63.1	Pond Creek nr. Louisville
27	03-3065.00	736.0	Green River at Greensburg
28	03-3070.00	188.0	Russell Creek nr. Columbia
29	03-3075.00	18.1	S. Fk. Little Barren R. at Edmonton
30	03-3100.00	36.4	N. Fork Nolin River at Hodgenville
31	03-3105.00	600.0	Nolin River at Wax
32	03-3110.00	673.0	Nolin River near Kyrock
33	03-3125.00	531.0	Barren River near Pageville
34	03-3140.00	478.0	Drakes Creek near Alvaton
35	03-3160.00	90.5	Mud River near Lewisburg

# INDEX OF SELECTED STATIONS IN KENTUCKY (Continued)

CTU No.	USGS No.	Drainage Area Sq. Mi.	Location of Stream Gage
36	03-3170.00	225.0	Rough River near Madrid
37	03-3190.00	757.0	Rough River near Dundee
38	03-3205.00	194.0	E. Fk. Pond. River near Apex
39	03-3830.00	255.0	Tradewater R. at Olney
40	03-4005.00	82.3	Poor Fork at Cumberland
41	03-4010.00	374.0	Cumberland R. near Harlan
42	03-4020.00	58.2	Yellow Cr. near Middlesboro
43	03-4030.00	809.0	Cumberland R. near Pineville
44	03-4035.00	960.0	Cumberland R. at Barbourville
45	03-4050.00	198.0	Laurel River at Corbin
46	03-4065.00	604.0	Rockcastle R. at Billows
47	03-4105.00	954.0	S. Fk. Cumberland R. near Stearns
48	03-4380.00	244.0	Little River near Cadiz
49	03-6105.00	227.0	E. Fk. Clarks R. near Benton
50	07-0230.00	211.0	Mayfield Cr. at Lovelaceville
51	07-0240.00	68.5	Bayou Du Chien near Clinton



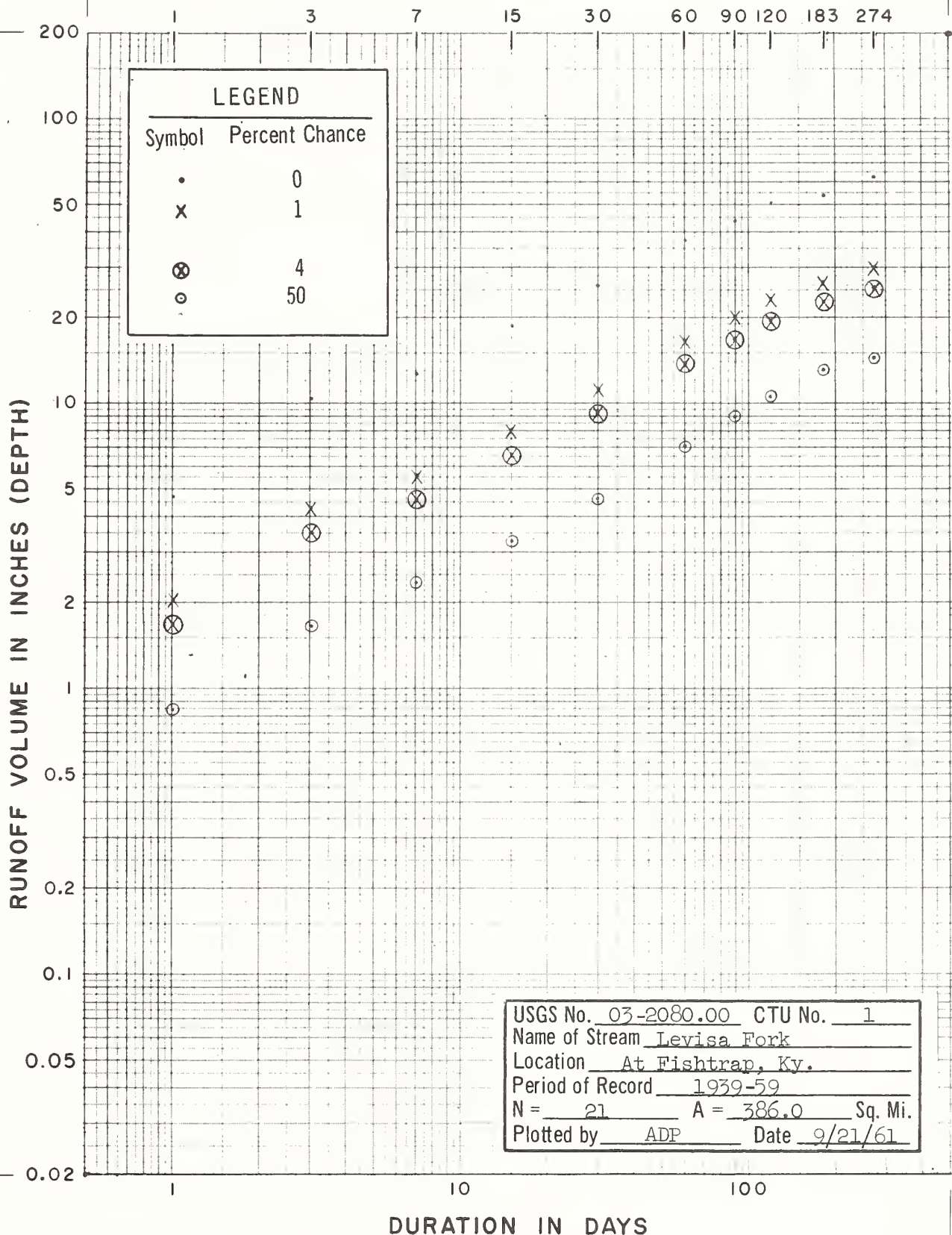
# Table of Contents for Kentucky

CTU No.	USGS No.	Period of Record	Location of Stream Gage
1	03-2080.00	1939-59	Levisa Fork at Fishtrap
2	03-2100.00	1942-59	Johns Cr. near Meta
3	03-2115.00	1940-59	Johns Cr. near Van Lear
4	03-2155.00	1916-59*	Blaine Cr. at Yatesville
4		1939-59	
5	03-2165.00	1939-59	Little Sandy R. near Grayson
6	03-2170.00	1941-59	Tygarts Cr. near Greenup
7	03-2485.00	1939-59	Licking R. near Salyersville
8	03-2495.00	1939-59	Licking Cr. at Farmers
9	03-2500.00	1942-59	Triplet Cr. at Morehead
10	03-2510.00	1947-59	N. Fk. Licking R. near Lewisburg
11	03-2525.00	1939-59	S. Fk. Licking R. at Cynthiana
12	03-2775.00	1941-59	N. Fk. Kentucky R. at Hazard
13	03-2810.00	1931-59	M. Fk. Kentucky R. at Tallega
13		1940-59	
14	03-2815.00	1926-59	S. Fk. Kentucky R. at Booneville
14		1940-59	
15	03-2835.00	1931-59	Red River at Clay City
15		1939-59	
16	03-2850.00	1943-59	Dix River near Danville
17	03-2855.00	1912-22	Dix River near Burgin
18	03-2895.00	1916-59	Elkhorn Cr. near Frankfort
18		1941-59	
19	03-2910.00	1942-59	Big Eagle Cr. at Sadieville
20	03-2915.00	1916-59	Eagle Cr. at Glencoe
20	03-2915.00	1939-59	Eagle Cr. at Glencoe
21	03-2925.00	1945-59	S. Fk. Beargrass Cr. at Louisville
22	03-2955.00	1939-59	Salt River near Van Buren
23	03-2980.00	1945-59	Floyds Fork at Fisherville
24	03-2990.00	1939-59	Rolling Fork near Lebanon
25	03-3010.00	1941-59	Beach Fork at Bardstown
26	03-3020.00	1945-59	Pond Cr. near Louisville
27	03-3065.00	1940-59	Green River at Greensburg
28	03-3070.00	1940-59	Russell Cr. near Columbia
29	03-3075.00	1942-59	S. Fk. Little Barren R. at Edmonton

Table of Contents for Kentucky (Contents)

CTU No.	USGS No.	Period of Record	Location of Stream Gage
30	03-3100.00	1942~59	N. Fk. Nolin R. at Hodgenville
31	03-3105.00	1937-59	Nolin River at Wax
32	03-3110.00	1931~50	Nolin River near Kyrock
33	03-3125.00	1940~59	Barren R. near Pageville
34	03-3140.00	1940~59	Drakes Cr. near Alvaton
35	03-3160.00	1940~59	Mud River near Lewisburg
36	03-3170.00	1939~59	Rough River near Madrid
37	03-3190.00	1941~59	Rough River near Dundee
38	03-3205.00	1941~59	E. Fk. Pond River near Apex
39	03-3830.00	1941~59	Tradewater R. at Olney
40	03-4005.00	1941~59	Poor Fork at Cumberland
41	03-4010.00	1941~59	Cumberland R. near Harlan
42	03-4020.00	1941~59	Yellow Cr. near Middlesboro
43	03-4030.00	1939~59	Cumberland R. near Pineville
44	03-4035.00	1923~59	Cumberland R. at Barbourville
45	03-4050.00	1923~59	Laurel River at Corbin
46	03-4065.00	1937~59	Rockcastle R. at Billows
47	03-4105.00	1943~59	S. Fk. Cumberland R. near Stearns
48	03-4380.00	1941~59	Little River near Cadiz
49	03-6105.00	1939~59	E. Fk. Clarks R. near Benton
50	07-0230.00	1939~59	Mayfield Cr. at Lovelaceville
51	07-0240.00	1940~59	Bayou Du Chien near Clinton

\*Throughout this publication, this symbol (~) indicates a discontinuous period of record.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

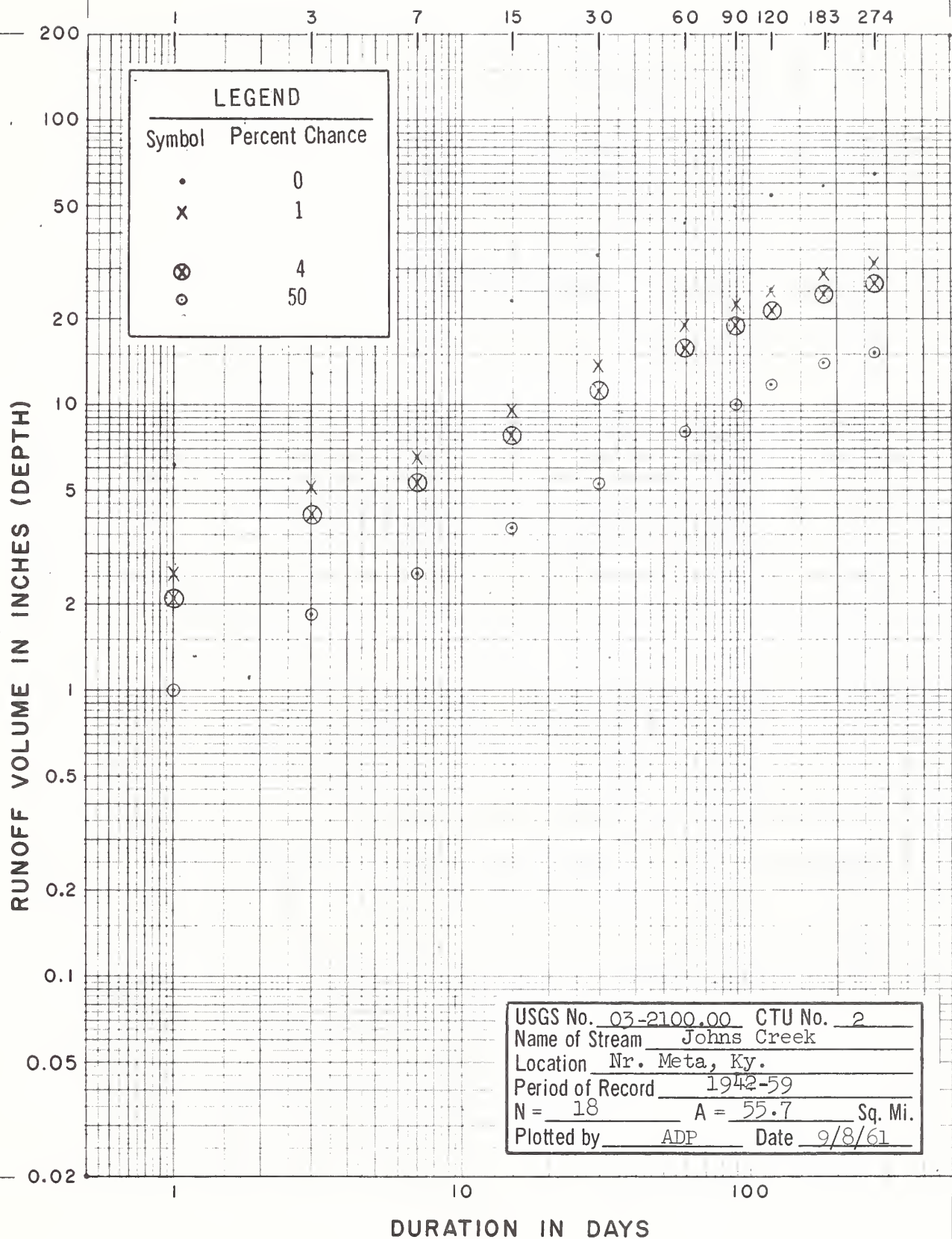
Name of Stream Levisa Fork Gage Location at Fishtrap, Kentucky  
 USGS No. 03-2080.00 CTU No. 1 Drainage Area 386.0 Sq. Mi.  
 Period of Record 1939-59 Date 9-5-61 N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.660	10.31	12.62	18.59	25.76	37.52	43.88	50.85	54.03	62.45
0.2	2.401	5.146	6.555	9.560	13.30	19.57	23.58	27.43	30.78	35.06
1	2.018	4.280	5.533	8.024	11.19	16.55	20.08	23.40	26.66	30.20
2	1.844	3.890	5.067	7.327	10.23	15.18	18.49	21.57	24.76	27.97
4	1.662	3.481	4.580	6.597	9.227	13.73	16.81	19.63	22.75	25.61
10	1.402	2.904	3.884	5.559	7.794	11.68	14.40	16.85	19.86	22.23
20	1.184	2.419	3.299	4.688	6.594	9.942	12.36	14.49	17.36	19.31
50	.831	1.649	2.346	3.281	4.645	7.111	9.000	10.60	13.19	14.48
80	.557	1.063	1.597	2.189	3.125	4.878	6.316	7.482	9.735	10.52
95	.360	.656	1.053	1.409	2.031	3.244	4.314	5.149	7.075	7.500
99	.237	.408	.707	.920	1.343	2.196	3.012	3.619	5.251	5.466
Y	5.275	4.516	5.671	5.188	5.416	5.881	6.658	6.766	8.715	8.022
B	.1677	.3945	.4378	.6745	.9147	1.279	1.429	1.643	1.564	1.885
B/V	.3851	.8383	1.043	1.536	2.129	3.101	3.687	4.273	4.618	5.338

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

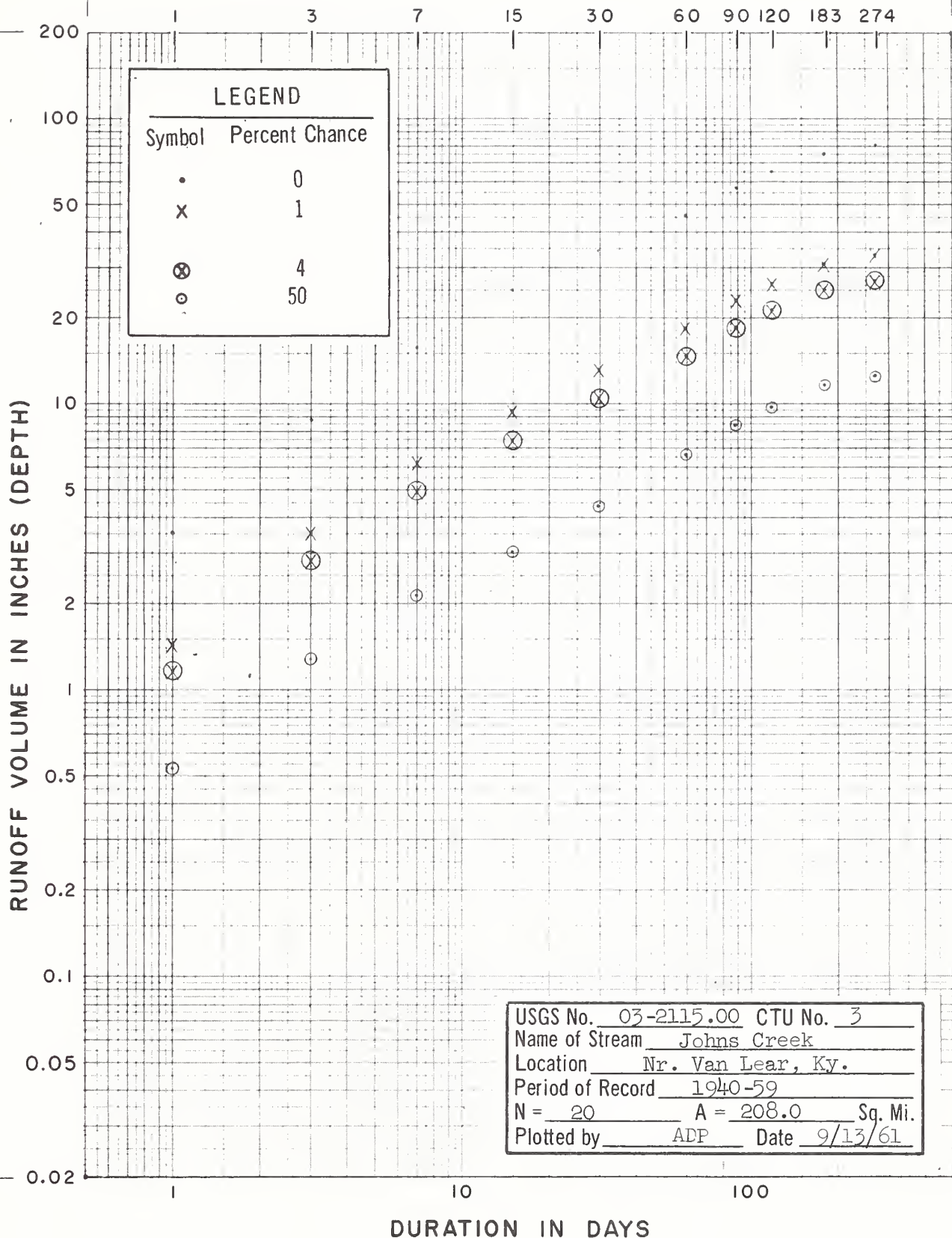
VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream Johns Creek Gage Location near Meta, Kentucky  
 USGS No. 03-2100.00 CTU No. 2 Drainage Area 55.7 Sq. Mi.  
 Period of Record 1942-59 Date 8-29-61 N = 18 Years

Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.150	12.88	15.63	23.28	33.69	44.09	50.38	54.83	59.55	65.46
0.2	3.101	6.300	7.895	11.62	16.78	22.86	26.97	30.07	33.68	36.88
1	2.583	5.183	6.584	9.666	13.94	19.27	22.93	25.74	29.09	31.82
2	2.349	4.680	5.993	8.784	12.66	17.64	21.09	23.76	26.99	29.49
4	2.104	4.156	5.373	7.862	11.32	15.93	19.15	21.67	24.76	27.03
10	1.758	3.420	4.496	6.557	9.422	13.49	16.37	18.68	21.55	23.49
20	1.467	2.808	3.760	5.463	7.836	11.45	14.02	16.12	18.78	20.45
50	1.004	1.851	2.584	3.724	5.319	8.115	10.16	11.90	14.18	15.38
80	.651	1.141	1.683	2.400	3.407	5.502	7.088	8.485	10.38	11.22
95	.404	.665	1.052	1.480	2.087	3.615	4.810	5.911	7.477	8.040
99	.254	.389	.665	.922	1.290	2.412	3.328	4.215	5.502	5.892
$\gamma$	4.553	3.826	4.661	4.494	4.423	5.636	6.485	7.184	8.454	8.189
$\beta$	.2362	.5313	.5933	.8932	1.303	1.535	1.663	1.734	1.750	1.955
$\beta/\gamma$	.5041	1.039	1.281	1.893	2.739	3.644	4.234	4.647	5.090	5.595

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

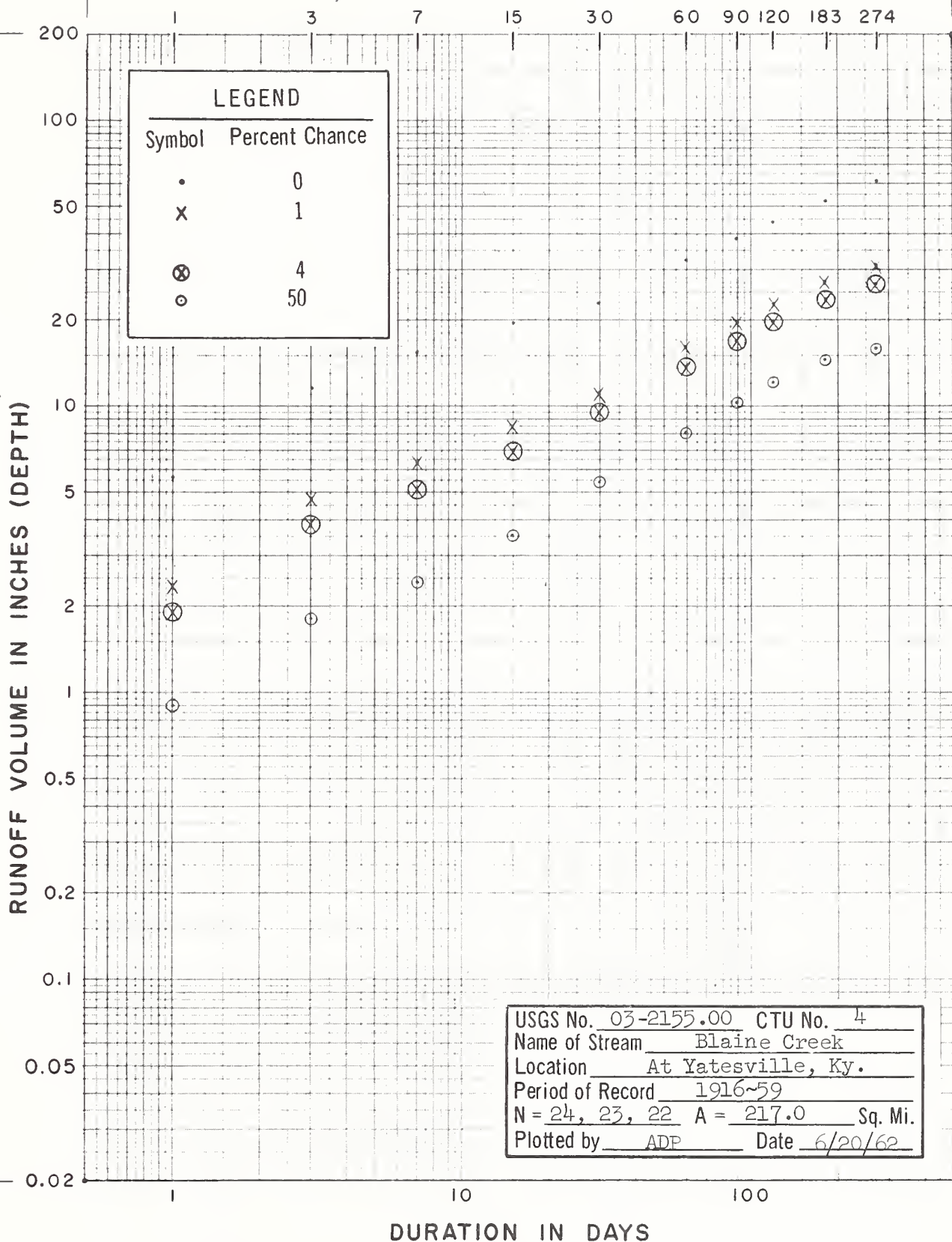
Name of Stream Johns Creek Gage Location near Van Lear, Kentucky  
 USGS No. 03-2115.00 CTU No. 3 Drainage Area 208.0 Sq. Mi.  
 Period of Record 1940-59 Date 8-31-61 N = 20 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.517	8.767	15.78	24.97	34.23	45.57	56.98	65.10	75.17	80.84
0.2	1.729	4.294	7.619	11.63	16.23	22.32	27.96	32.00	37.38	40.20
1	1.429	3.539	6.232	9.432	13.22	18.39	23.08	26.45	30.99	33.33
2	1.294	3.198	5.608	8.445	11.87	16.63	20.88	23.96	28.12	30.24
4	1.153	2.844	4.961	7.425	10.46	14.78	18.59	21.35	25.12	27.01
10	.955	2.346	4.055	6.007	8.514	12.19	15.36	17.68	20.88	22.45
20	.790	1.930	3.305	4.842	6.902	10.03	12.67	14.62	17.33	18.64
50	.528	1.279	2.142	3.049	4.412	6.648	8.436	9.781	11.71	12.59
80	.332	.794	1.287	1.768	2.606	4.127	5.275	6.153	7.462	8.024
95	.199	.467	.728	.951	1.439	2.429	3.129	3.686	4.534	4.876
99	.120	.276	.410	.503	.790	1.433	1.866	2.216	2.781	2.990
γ	4.099	3.935	3.528	3.139	3.313	3.937	3.991	4.118	4.262	4.297
β	.1401	.3564	.6720	1.093	1.481	1.852	2.300	2.587	2.960	3.170
β/γ	.2836	.7070	1.262	1.936	2.695	3.675	4.595	5.250	6.111	6.572

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

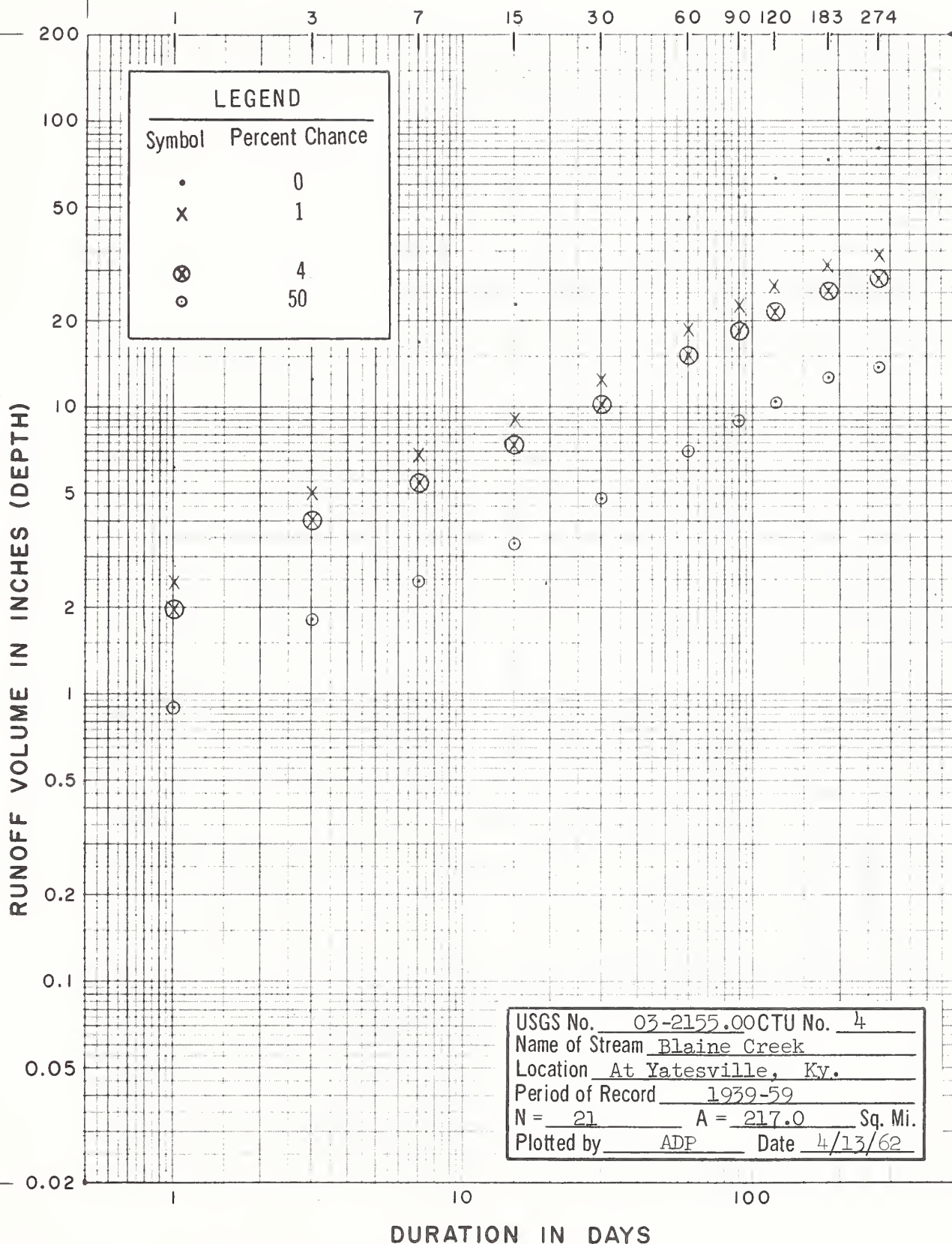
Name of Stream Blaine Creek at Yatesville, Kentucky  
 USGS No. 03-2155.00 CTU No. 4 Drainage Area 217.0 Sq. Mi.  
 Period of Record 1916-59 Date 4/13/62 N = 24, 23, 22 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.679	11.60	15.44	19.57	22.94	32.53	38.54	44.16	52.34	61.85
0.2	2.829	5.766	7.691	10.13	12.97	18.67	22.68	26.26	31.22	35.88
1	2.350	4.781	6.387	8.529	11.21	16.21	19.83	23.03	27.40	31.25
2	2.134	4.338	5.799	7.801	10.40	15.07	18.52	21.53	25.64	29.12
4	1.908	3.874	5.186	7.041	9.539	13.87	17.13	19.96	23.78	26.87
10	1.588	3.220	4.317	5.956	8.301	12.14	15.10	17.65	21.05	23.58
20	1.321	2.673	3.591	5.045	7.236	10.64	13.36	15.66	18.69	20.76
50	.897	1.806	2.437	3.565	5.462	8.129	10.40	12.26	14.67	15.99
80	.574	1.151	1.561	2.409	4.001	6.047	7.900	9.399	11.27	12.01
95	.352	.699	.956	1.574	2.881	4.429	5.939	7.127	8.571	8.902
99	.217	.429	.591	1.045	2.120	3.314	4.552	5.511	6.648	6.735
$\gamma$	4.399	4.296	4.446	5.523	8.499	9.114	10.50	11.12	11.33	9.842
$\beta$	.2201	.4548	.5954	.6883	.6727	.9209	1.017	1.132	1.329	1.685
$\beta/\gamma$	.4617	.9427	1.255	1.618	1.961	2.780	3.294	3.775	4.474	5.286

**Remarks:**

1954 appeared as a low outlier and was deleted from the 15-274 day durations.  
 1941 appeared as a low outlier and was deleted from the 30-274 day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Blaine Creek Gage Location at Yatesville, Kentucky  
 USGS No. 03-2155.00 CTU No. 4 Drainage Area 217.0 Sq. Mi.  
 Period of Record 1939-59 Date 4-13-62 N = 21 Years

**Runoff Volume in Inches (Depth)**

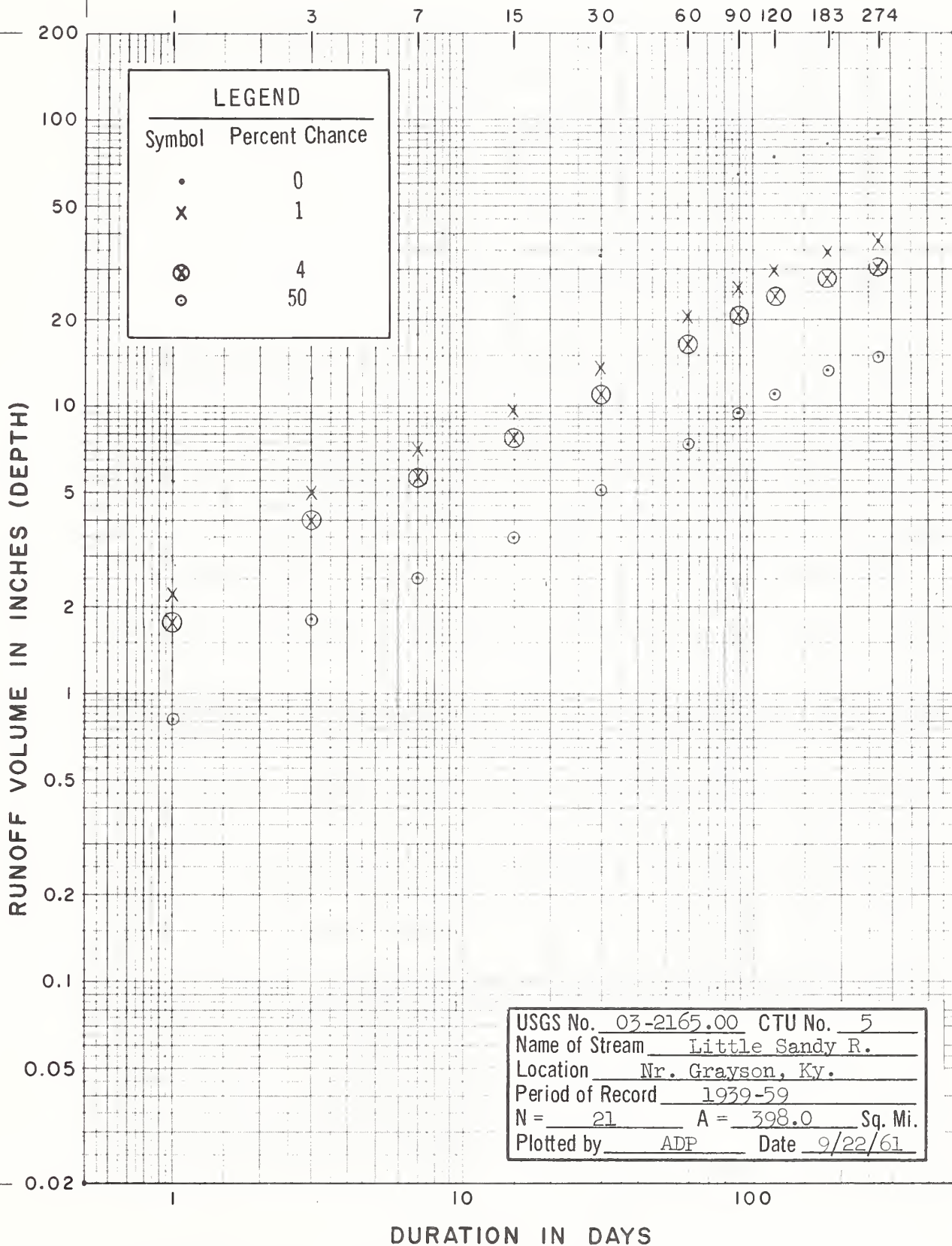
**Duration in Days**

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	6.083	12.45	16.75	22.64	30.48	45.83	53.77	62.94	73.00	80.32
0.2	2.980	6.098	8.219	11.11	15.19	22.75	27.21	31.86	37.47	41.15
1	2.455	5.025	6.785	9.170	12.61	18.84	22.73	26.60	31.41	34.45
2	2.219	4.542	6.139	8.297	11.45	17.08	20.70	24.23	28.67	31.42
4	1.973	4.038	5.465	7.386	10.24	15.24	18.58	21.75	25.79	28.24
10	1.628	3.331	4.516	6.104	8.524	12.64	15.57	18.22	21.71	23.74
20	1.339	2.741	3.725	5.034	7.090	10.47	13.04	15.27	18.27	19.95
50	.887	1.816	2.480	3.353	4.812	7.042	8.995	10.53	12.74	13.87
80	.551	1.127	1.551	2.096	3.083	4.460	5.892	6.898	8.464	9.167
95	.324	.664	.920	1.244	1.888	2.690	3.706	4.339	5.418	5.835
99	.191	.392	.549	.741	1.167	1.632	2.358	2.760	3.517	3.764
Y	3.916	3.857	3.953	3.985	4.392	4.192	4.794	4.811	5.079	5.046
B	.2479	.5114	.6793	.9146	1.182	1.820	2.013	2.352	2.677	2.955
B/V	.4906	1.004	1.351	1.826	2.478	3.726	4.407	5.159	6.033	6.638

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

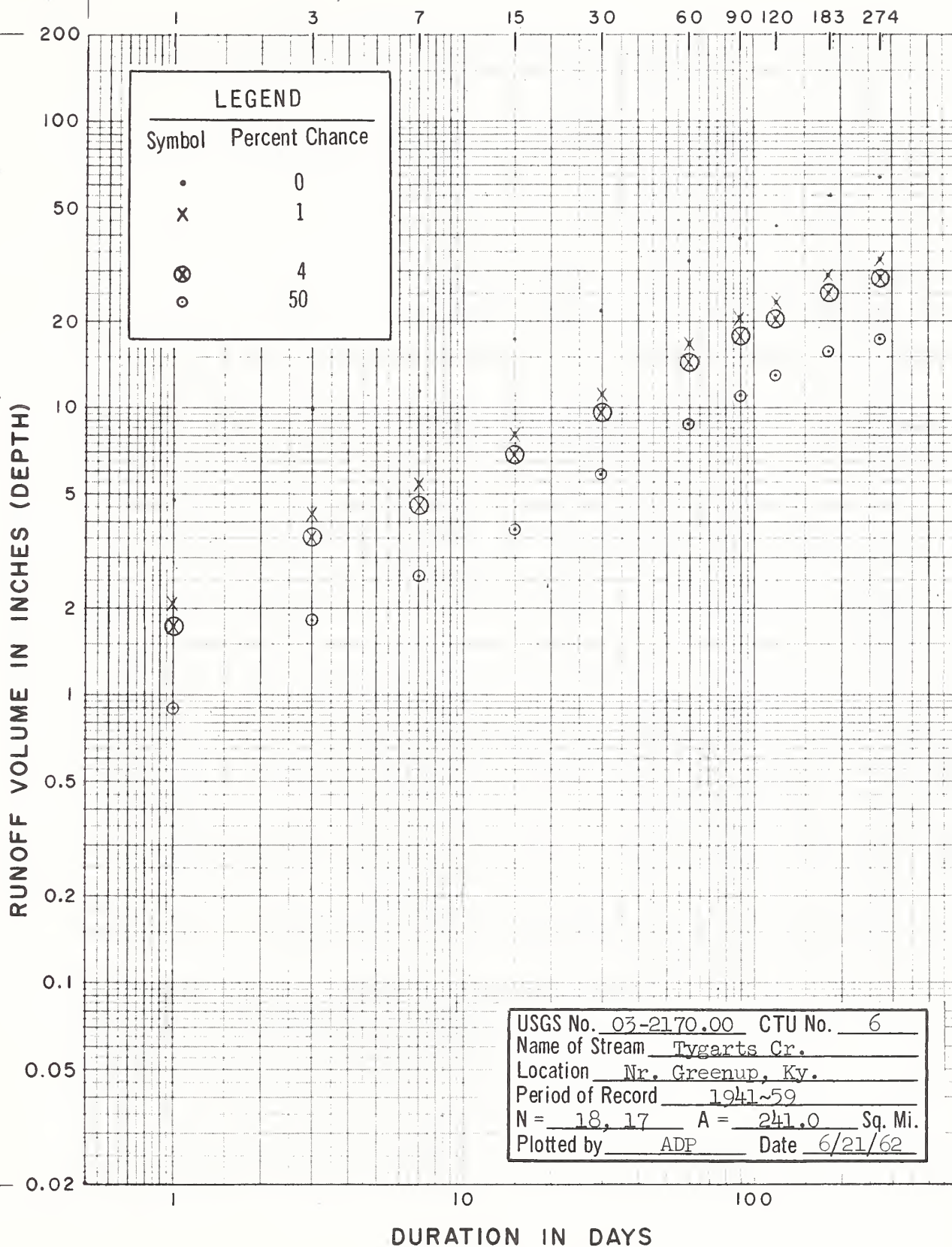
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Little Sandy River Gage Location near Grayson, Kentucky  
 USGS No. 03-2165.00 CTU No. 5 Drainage Area 398.0 Sq. Mi.  
 Period of Record 1939-59 Date 9-5-61 N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.392	12.38	17.60	23.89	33.16	51.21	63.87	73.45	81.67	88.62
0.2	2.650	6.064	8.605	11.70	16.46	25.04	31.34	36.10	41.17	44.86
1	2.191	4.996	7.078	9.645	13.63	20.60	25.87	29.85	34.29	37.46
2	1.984	4.516	6.391	8.718	12.36	18.60	23.41	27.03	31.19	34.11
4	1.768	4.015	5.676	7.750	11.02	16.52	20.84	24.09	27.94	30.62
10	1.464	3.312	4.671	6.394	9.145	13.60	17.22	19.95	23.34	25.66
20	1.210	2.725	3.836	5.261	7.576	11.16	14.20	16.49	19.49	21.49
50	.810	1.806	2.529	3.486	5.095	7.360	9.457	11.03	13.33	14.83
80	.510	1.121	1.558	2.164	3.227	4.535	5.913	6.942	8.642	9.712
95	.305	.660	.908	1.274	1.947	2.643	3.508	4.158	5.369	6.109
99	.183	.389	.531	.752	1.181	1.545	2.091	2.500	3.367	3.886
$\gamma$	4.147	3.883	3.801	3.886	4.218	3.809	4.003	4.145	4.615	4.755
$\beta$	.2135	.5066	.7278	.9776	1.313	2.116	2.574	2.909	3.116	3.331
$\beta\sqrt{\gamma}$	.4348	.9983	1.419	1.927	2.696	4.130	5.151	5.923	6.694	7.264

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

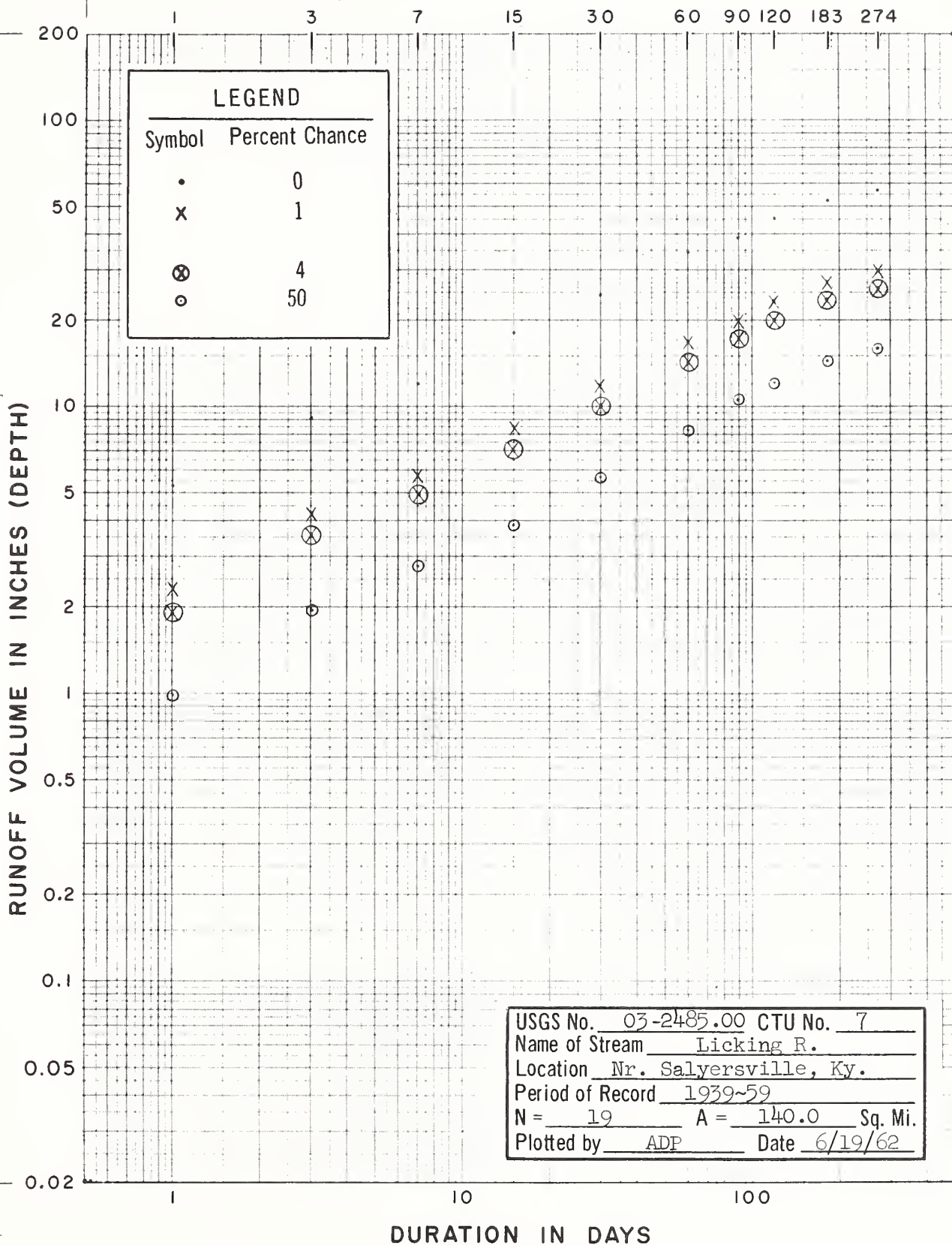
Name of Stream Tygarts Creek Gage Location near Greenup, Kentucky  
 USGS No. 03-2170.00 CTU No. 6 Drainage Area 241.0 Sq. Mi.  
 Period of Record 1941-59 Date 6-21-62 N = 18,17 Years

% Probability (Greater than)	Runoff Volume in Inches (Depth)										Duration in Days	
	1	3	7	15	30	60	90	120	183	274		
0.0	4.709	9.747	11.35	17.26	21.63	32.43	39.01	43.17	55.00	63.81		
0.2	2.457	5.063	6.295	9.461	12.73	19.08	23.34	26.42	33.03	37.67		
1	2.071	4.273	5.415	8.098	11.13	16.69	20.57	23.36	29.04	32.98		
2	1.898	3.913	5.012	7.477	10.39	15.58	19.20	21.93	27.20	30.81		
4	1.716	3.537	4.585	6.820	9.616	14.42	17.81	20.40	25.25	28.52		
10	1.458	3.000	3.973	5.878	8.476	12.71	15.78	18.20	22.39	25.17		
20	1.239	2.548	3.446	5.073	7.499	11.24	14.03	16.27	19.92	22.29		
50	.884	1.812	2.574	3.744	5.835	8.748	11.03	12.96	15.70	17.38		
80	.604	1.233	1.862	2.670	4.434	6.647	8.498	10.14	12.12	13.25		
95	.400	.814	1.320	1.860	3.334	4.997	6.481	7.875	9.271	9.991		
99	.270	.546	.958	1.326	2.555	3.831	5.041	6.232	7.231	7.679		
Y	5.799	5.692	7.896	7.165	10.57	10.58	11.61	13.02	11.79	10.74		
B	.1616	.3376	.3424	.5463	.5686	.8521	.9785	1.023	1.369	1.664		
B/V	.3892	.8055	.9621	1.462	1.849	2.772	3.334	3.690	4.701	5.454		

Remarks:

1954 appeared as a low outlier and was deleted from all durations.  
 1941 appeared as a low outlier and was deleted from the 30-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

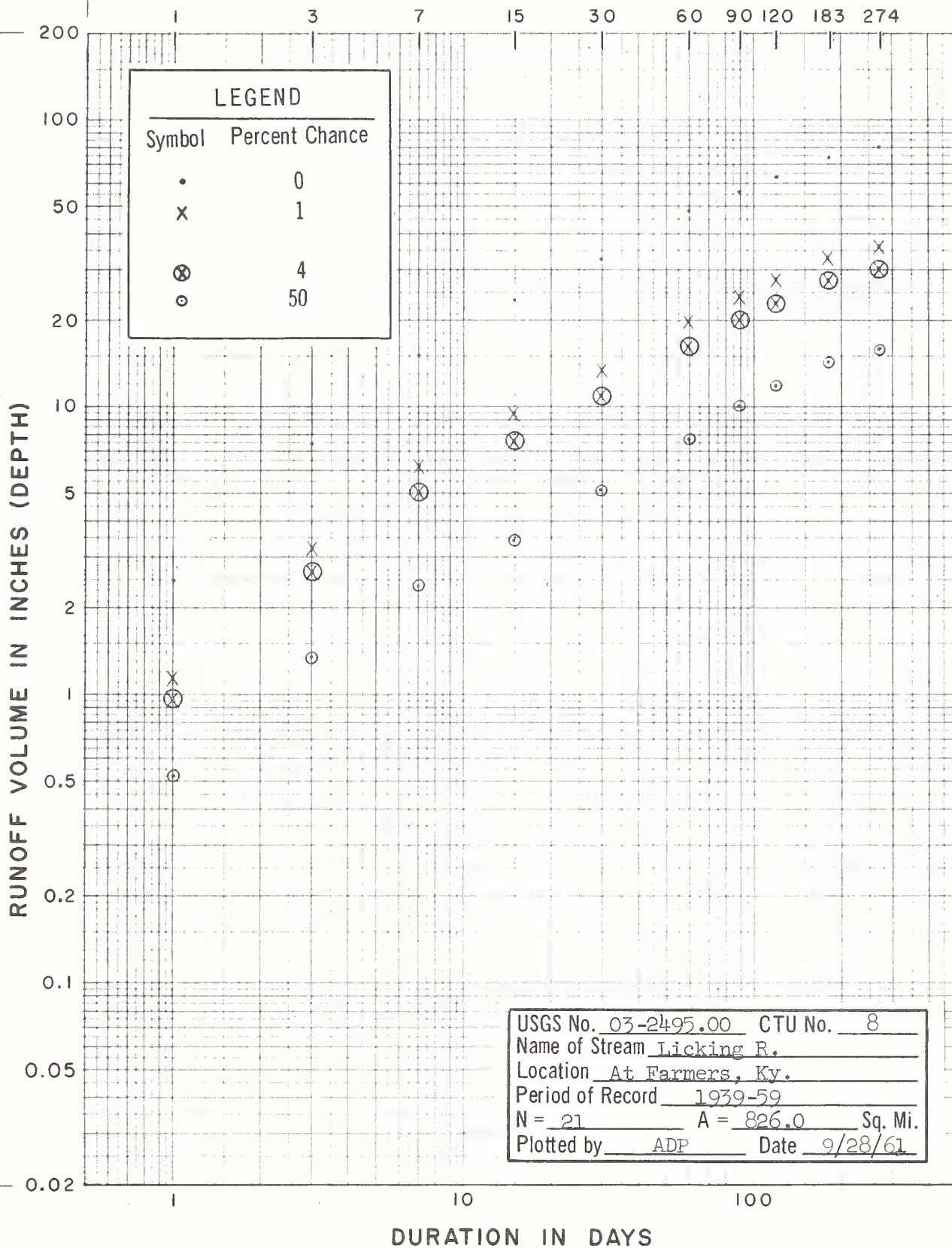
Name of Stream Licking River Gage Location near Salversville, Kentucky  
 USGS No. 03-2485.00 CTU No. 7 Drainage Area 140.0 Sq. Mi.  
 Period of Record 1939-59 Date 9/7/61 N = 19 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.245	9.094	11.93	18.05	24.50	34.28	38.68	45.35	52.11	56.55
0.2	2.725	4.967	6.699	9.861	13.75	19.46	22.84	26.69	30.98	33.84
1	2.300	4.245	5.771	8.427	11.85	16.83	19.99	23.33	27.17	29.73
2	2.106	3.915	5.345	7.772	10.97	15.62	18.68	21.79	25.41	27.83
4	1.903	3.568	4.894	7.082	10.05	14.35	17.29	20.16	23.55	25.82
10	1.614	3.069	4.247	6.092	8.719	12.50	15.26	17.77	20.82	22.88
20	1.371	2.644	3.690	5.249	7.576	10.91	13.51	15.72	18.48	20.34
50	.975	1.943	2.766	3.857	5.679	8.266	10.54	12.23	14.47	16.00
80	.664	1.379	2.009	2.737	4.125	6.080	8.030	9.294	11.09	12.32
95	.438	.955	1.433	1.896	2.942	4.397	6.057	6.988	8.409	9.395
99	.294	.676	1.044	1.342	2.144	3.252	4.655	5.357	6.503	7.307
$\gamma$	5.669	7.027	7.994	6.965	7.975	8.679	10.74	10.50	11.26	11.51
$\beta$	.1821	.2907	.3608	.5801	.7416	.9947	1.009	1.196	1.328	1.424
$\beta/\gamma$	.4335	.7707	1.020	1.530	2.094	2.930	3.306	3.876	4.454	4.833

Remarks:

1941 and 1954 appeared as low outliers and were deleted from all durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

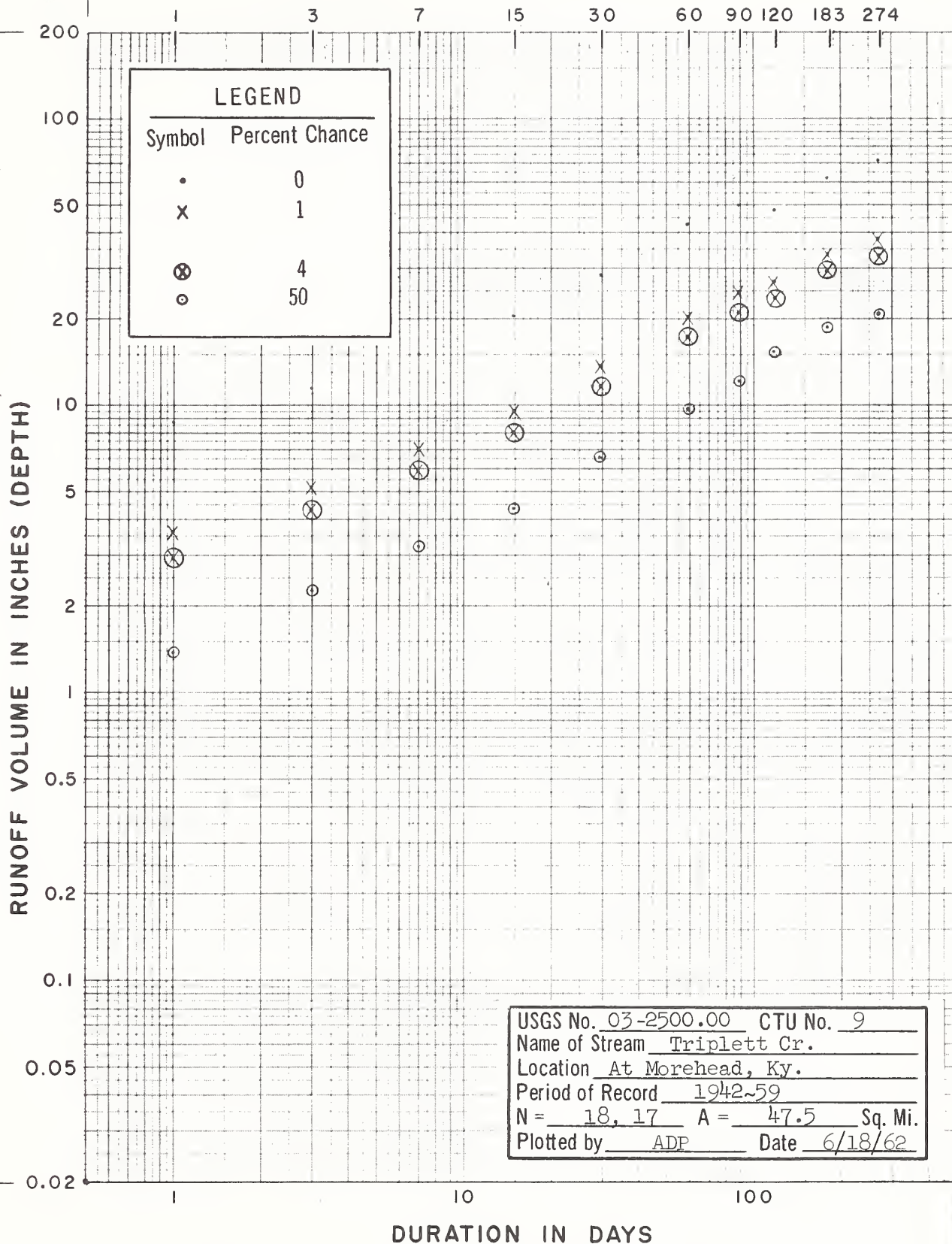
Name of Stream Licking River at Farmers, Kentucky  
 USGS No. 03-2495.00 CTU No. 8 Drainage Area 826.0 Sq. Mi.  
 Period of Record 1939-59 Date 9-7-61 N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	2.473	7.431	15.09	23.57	32.69	48.09	55.95	63.16	73.91	80.50
0.2	1.334	3.844	7.519	11.55	16.29	24.00	28.89	32.87	39.27	42.94
1	1.138	3.238	6.244	9.515	13.53	19.96	24.30	27.78	33.25	36.42
2	1.049	2.962	5.670	8.600	12.28	18.14	22.22	25.45	30.50	33.46
4	.955	2.673	5.070	7.646	10.98	16.24	20.04	23.02	27.63	30.34
10	.820	2.261	4.221	6.308	9.144	13.54	16.93	19.55	23.51	25.88
20	.705	1.915	3.510	5.190	7.605	11.28	14.32	16.63	20.05	22.12
50	.516	1.353	2.383	3.439	5.162	7.691	10.09	11.85	14.38	15.95
80	.364	.914	1.526	2.135	3.307	4.958	6.788	8.101	9.900	11.05
95	.250	.598	.935	1.257	2.025	3.058	4.411	5.366	6.609	7.442
99	.176	.397	.578	.741	1.252	1.904	2.918	3.617	4.497	5.108
$\gamma$	6.704	5.509	4.371	3.892	4.385	4.475	5.376	5.817	6.011	6.183
$\beta$	.0737	.2182	.4732	.7893	1.092	1.462	1.530	1.625	1.982	2.313
$\beta/\gamma$	.2078	.6141	1.227	1.901	2.658	3.910	4.624	5.220	6.211	6.765

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

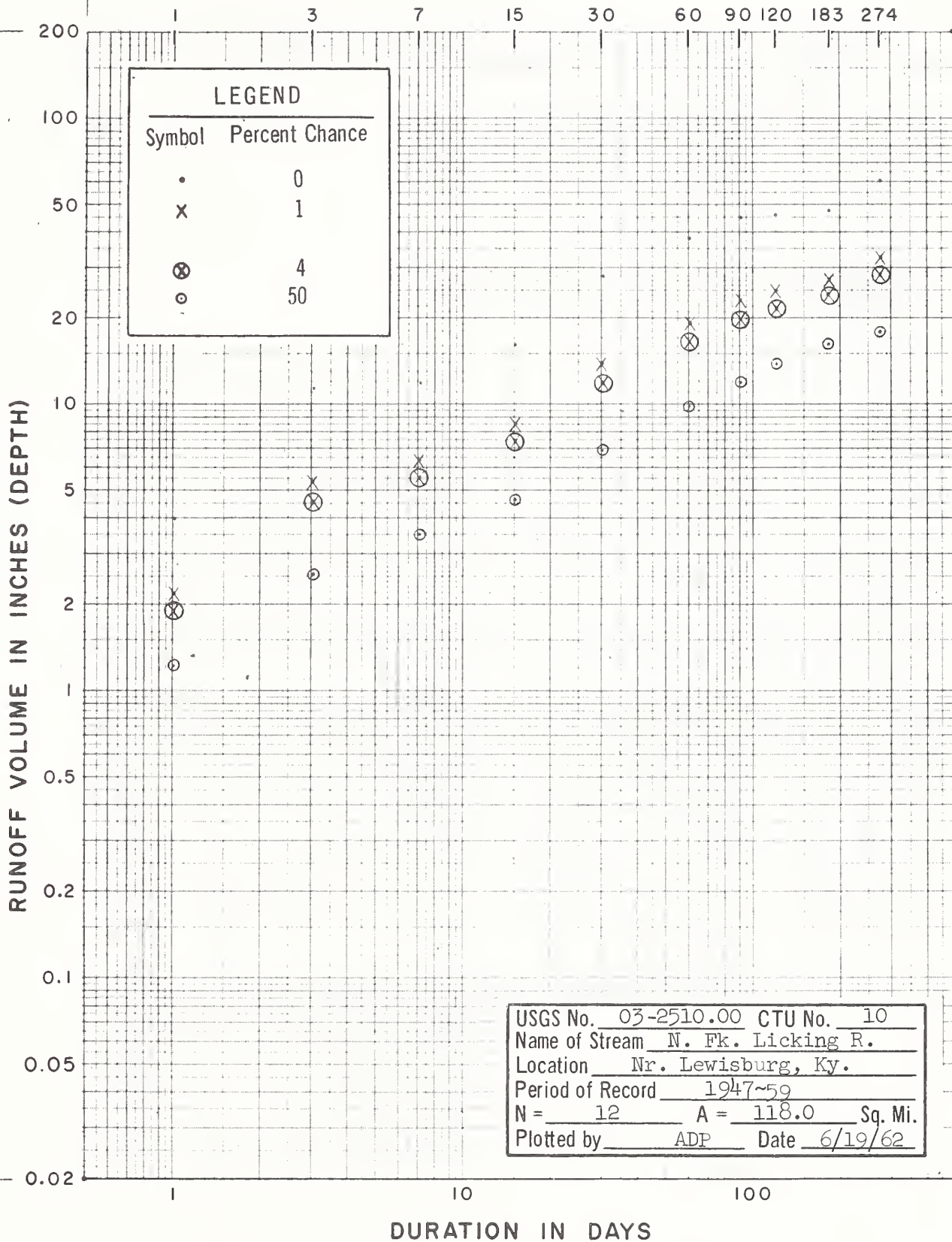
Name of Stream Triplet Creek Gage Location at Morehead, Kentucky  
 USGS No. 03-2500.00 CTU No. 9 Drainage Area 47.5 Sq. Mi.  
 Period of Record 1942-59 Date 9/7/61 N = 18, 17 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	8.678	11.43	15.07	20.52	28.48	42.96	50.19	48.30	62.79	72.20
0.2	4.323	6.098	8.230	11.21	15.99	23.82	28.60	30.38	38.43	43.64
1	3.590	5.173	7.034	9.578	13.77	20.49	24.77	27.03	33.98	38.45
2	3.260	4.752	6.487	8.834	12.75	18.97	23.00	25.46	31.90	36.04
4	2.915	4.309	5.911	8.050	11.68	17.35	21.14	23.79	29.67	33.47
10	2.427	3.676	5.085	6.925	10.14	15.03	18.45	21.35	26.47	29.75
20	2.018	3.142	4.381	5.967	8.806	13.04	16.13	19.22	23.66	26.51
50	1.370	2.266	3.219	4.384	6.601	9.740	12.25	15.53	18.85	20.97
80	.878	1.570	2.285	3.111	4.795	7.045	9.043	12.34	14.75	16.27
95	.538	1.057	1.582	2.155	3.420	4.995	6.572	9.750	11.45	12.50
99	.332	.725	1.120	1.525	2.492	3.626	4.878	7.860	9.065	9.806
$\gamma$	4.416	6.140	6.924	7.052	8.004	7.872	8.818	14.72	12.91	12.12
$\beta$	.3357	.3877	.4854	.6550	.8604	1.298	1.445	1.076	1.494	1.773
$\beta/\gamma$	.7055	.9608	1.277	1.739	2.434	3.641	4.290	4.128	5.367	6.171

**Remarks:**

1954 appeared as a low outlier and was deleted from the 120, 183, and 274-day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream N. F. Licking River Gage Location near Lewisburg, Kentucky  
 USGS No. 03-2510.00 CTU No. 10 Drainage Area 118.0 Sq. Mi.  
 Period of Record 1947-59 Date 6/22/62 N = 12 Years

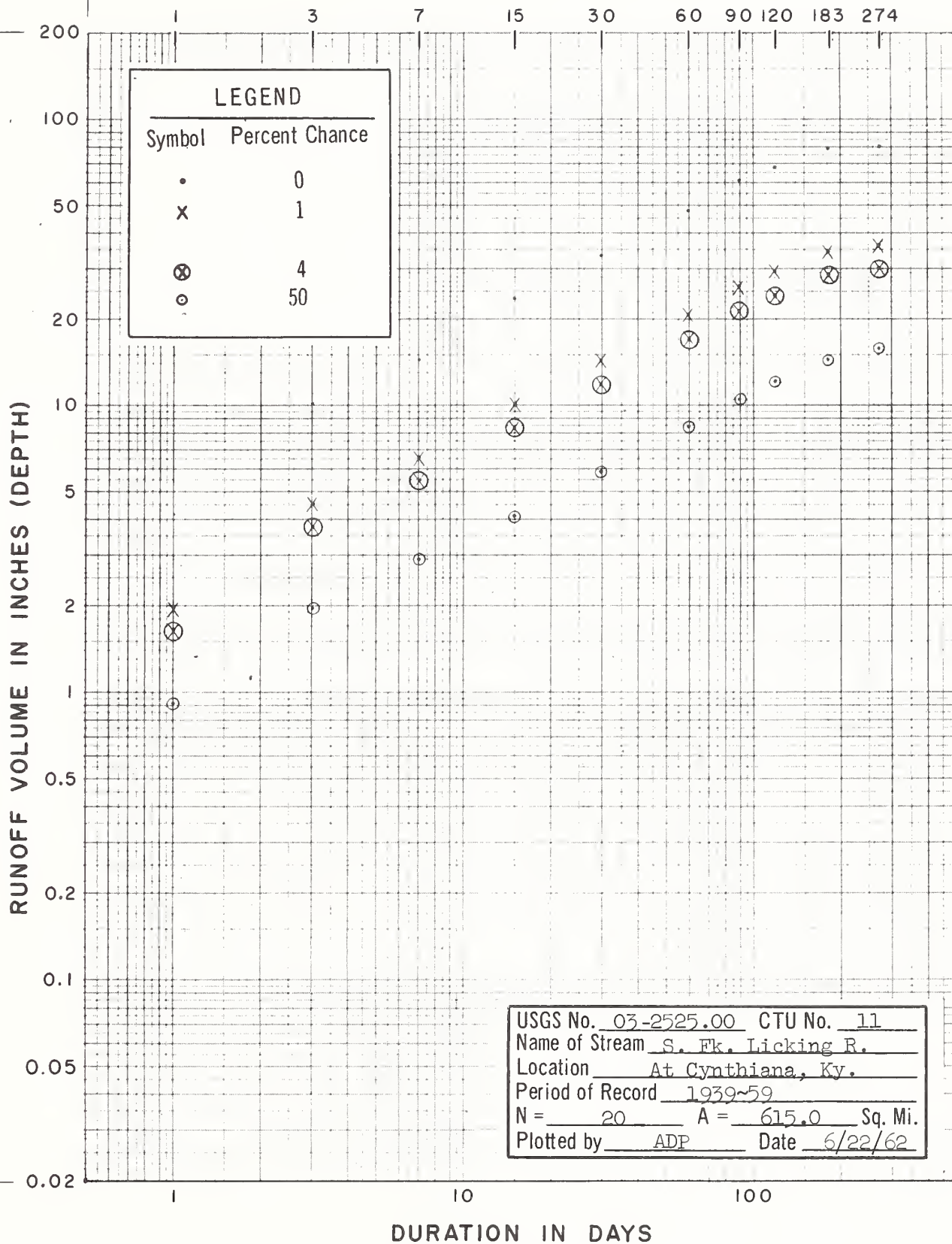
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.911	11.15	11.68	15.91	27.69	37.77	44.89	45.78	47.80	60.47
0.2	2.416	6.183	7.126	9.617	15.84	21.91	26.23	28.02	30.42	36.78
1	2.141	5.318	6.295	8.473	13.73	19.08	22.89	24.77	27.22	32.46
2	2.012	4.923	5.908	7.942	12.76	17.78	21.36	23.26	25.72	30.45
4	1.875	4.503	5.494	7.377	11.74	16.41	19.73	21.63	24.16	28.30
10	1.676	3.902	4.897	6.557	10.26	14.40	17.35	19.30	21.78	25.20
20	1.502	3.385	4.373	5.843	8.980	12.68	15.32	17.25	19.72	22.49
50	1.203	2.528	3.478	4.621	6.841	9.765	11.86	13.75	16.14	17.86
80	.946	1.829	2.715	3.585	5.707	7.334	8.963	10.76	13.02	13.59
95	.739	1.297	2.103	2.755	3.700	5.436	6.692	8.350	10.45	10.75
99	.589	.941	1.662	2.161	2.758	4.112	5.096	6.609	8.556	8.476
$\gamma$	13.61	7.765	12.80	12.13	9.099	9.780	10.22	12.95	16.78	12.60
$\beta$	.0906	.3391	.2790	.3904	.7848	1.033	1.200	1.087	.9807	1.456
$\beta/\gamma$	.3343	.9450	.9983	1.360	2.367	3.228	3.837	3.913	4.017	5.168

Remarks:

1954 appeared as a low outlier and was deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream S. F. Licking River Gage Location at Cynthiana, Kentucky  
 USGS No. 03-2525.00 CTU No. 11 Drainage Area 615.0 Sq. Mi.  
 Period of Record 1939-59 Date 6/22/62 N = 20 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.105	10.04	14.37	23.51	33.20	47.68	60.82	67.58	78.78	80.25
0.2	2.259	5.335	7.692	12.07	17.08	24.53	31.16	34.89	40.84	42.80
1	1.937	4.518	6.539	10.12	14.33	20.59	26.09	29.35	34.43	36.13
2	1.790	4.145	6.012	9.233	13.09	18.80	23.79	26.84	31.52	33.35
4	1.634	3.754	5.459	8.307	11.78	16.93	21.39	24.20	28.46	30.24
10	1.411	3.195	4.667	6.991	9.929	14.26	17.97	20.45	24.11	25.80
20	1.220	2.724	3.999	5.885	8.373	12.03	15.11	17.30	20.45	22.05
50	.9041	1.954	2.898	4.104	5.860	8.418	10.50	12.19	14.50	15.90
80	.6481	1.345	2.021	2.726	3.910	5.616	6.941	8.199	9.831	11.02
95	.4543	.8990	1.371	1.745	2.516	3.614	4.418	5.328	6.458	7.418
99	.3259	.6110	.9489	1.133	1.643	2.361	2.850	3.524	4.310	5.091
Y	7.473	5.985	6.321	5.091	5.205	5.199	5.027	5.397	5.578	6.114
B	.1273	.3450	.4802	.8611	1.203	1.728	2.242	2.404	2.757	2.727
B/V	.3479	.8439	1.207	1.943	2.744	3.941	5.026	5.585	6.510	6.743

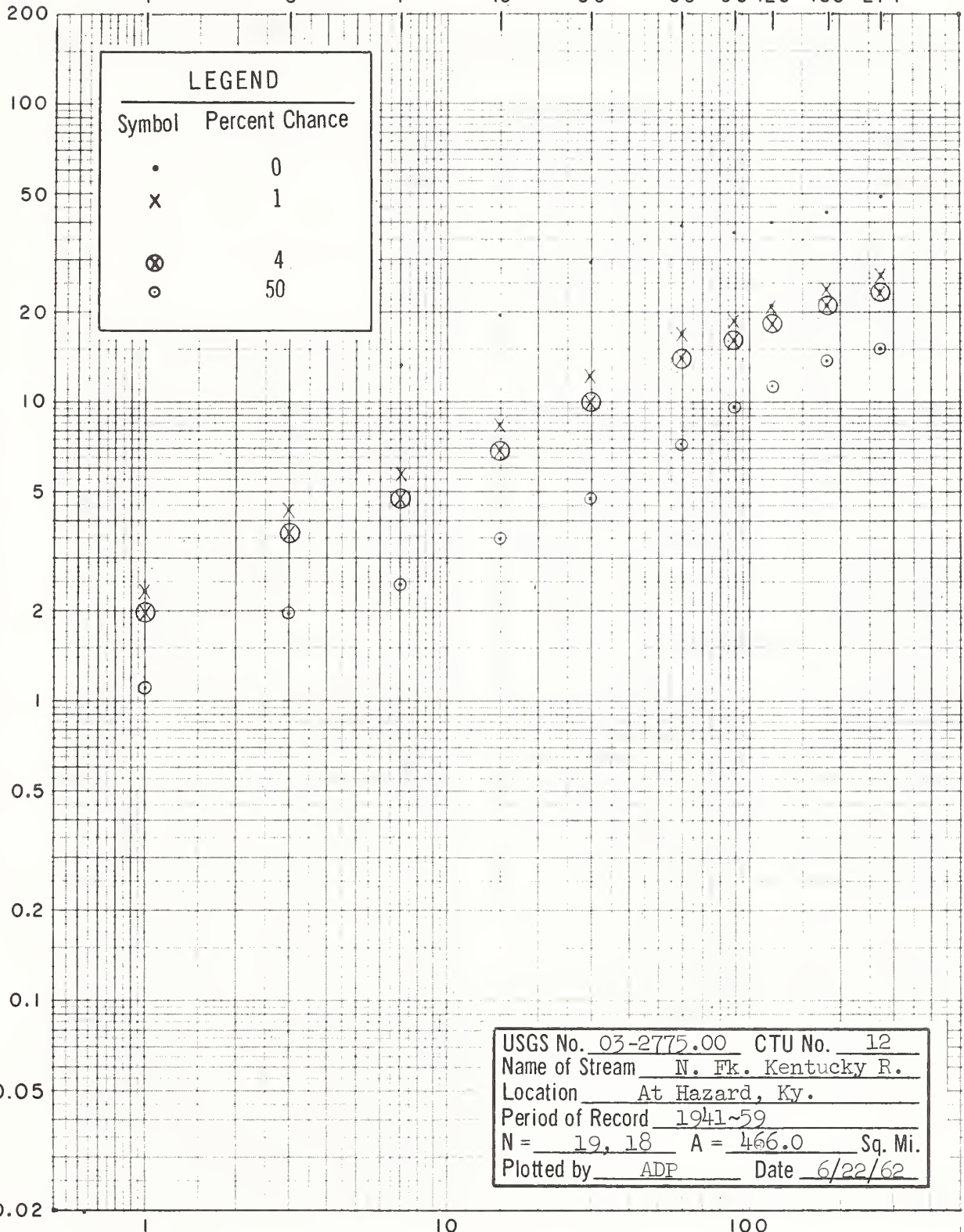
Remarks:

1954 appeared as a low outlier and was deleted from all durations.

RUNOFF VOLUME IN INCHES (DEPTH)

1 3 7 15 30 60 90 120 183 274

LEGEND	
Symbol	Percent Chance
•	0
x	1
⊗	4
○	50



USGS No. <u>03-2775.00</u>	CTU No. <u>12</u>
Name of Stream <u>N. Fk. Kentucky R.</u>	
Location <u>At Hazard, Ky.</u>	
Period of Record <u>1941~59</u>	
N = <u>19, 18</u>	A = <u>466.0</u> Sq. Mi.
Plotted by <u>ADP</u>	Date <u>6/22/62</u>

DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream N. F. Kentucky River Gage Location at Hazard, Kentucky  
 USGS No. 03-2775.00 CTU No. 12 Drainage Area 466.0 Sq. Mi.  
 Period of Record 1941-59 Date 6-22-62 N = 19, 18 Years

**Runoff Volume in Inches (Depth)**

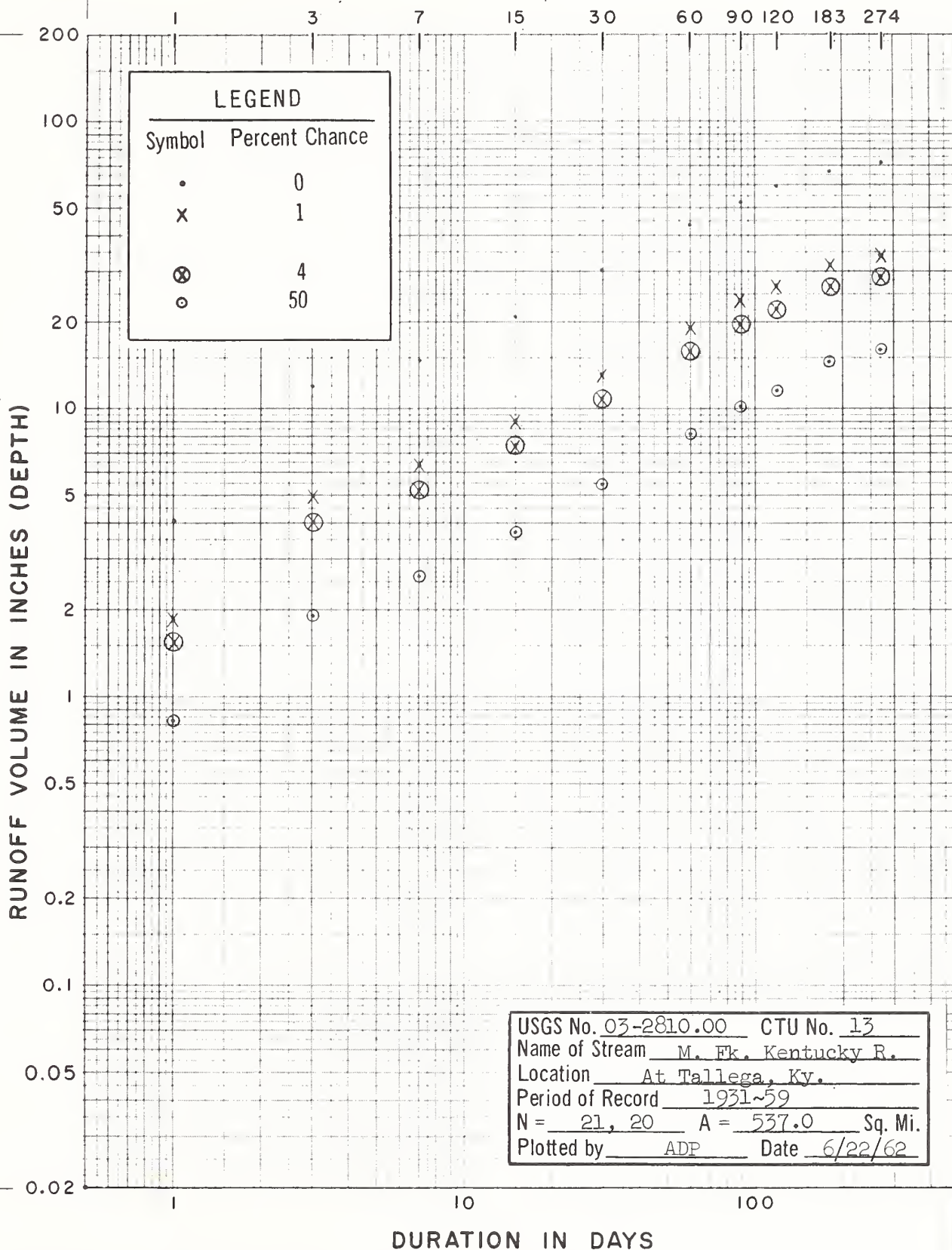
% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	4.825	9.510	13.20	19.40	29.08	38.51	36.34	39.70	42.85	48.58
0.2	2.675	5.111	6.844	9.996	14.66	20.04	21.31	23.84	26.88	30.10
1	2.301	4.353	5.770	8.400	12.21	16.94	18.61	20.96	23.90	26.69
2	2.130	4.007	5.282	7.675	11.11	15.52	17.37	19.63	22.50	25.10
4	1.948	3.642	4.770	6.917	9.951	14.04	16.06	18.22	21.01	23.39
10	1.688	3.121	4.040	5.835	8.313	11.92	14.14	16.16	18.85	20.93
20	1.465	2.679	3.427	4.928	6.940	10.14	12.50	14.32	16.95	18.77
50	1.094	1.951	2.430	3.461	4.749	7.229	9.699	11.33	13.68	15.06
80	.791	1.409	1.647	2.318	3.078	4.940	7.351	8.748	10.86	11.87
95	.561	.935	1.082	1.500	1.912	3.272	5.510	6.692	8.559	9.289
99	.407	.653	.722	.986	1.199	2.206	4.208	5.219	6.889	7.416
Y	7.823	6.530	5.577	5.298	4.642	5.802	10.37	11.81	14.55	13.87
B	.1462	.3127	.4622	.6963	1.107	1.322	.9644	.9874	.9602	1.115
B/Y	.4089	.7991	1.091	1.603	2.384	3.183	3.106	3.393	3.663	4.152

Remarks:

1941 appeared as a low outlier and was deleted from the 1,3 and 90-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS



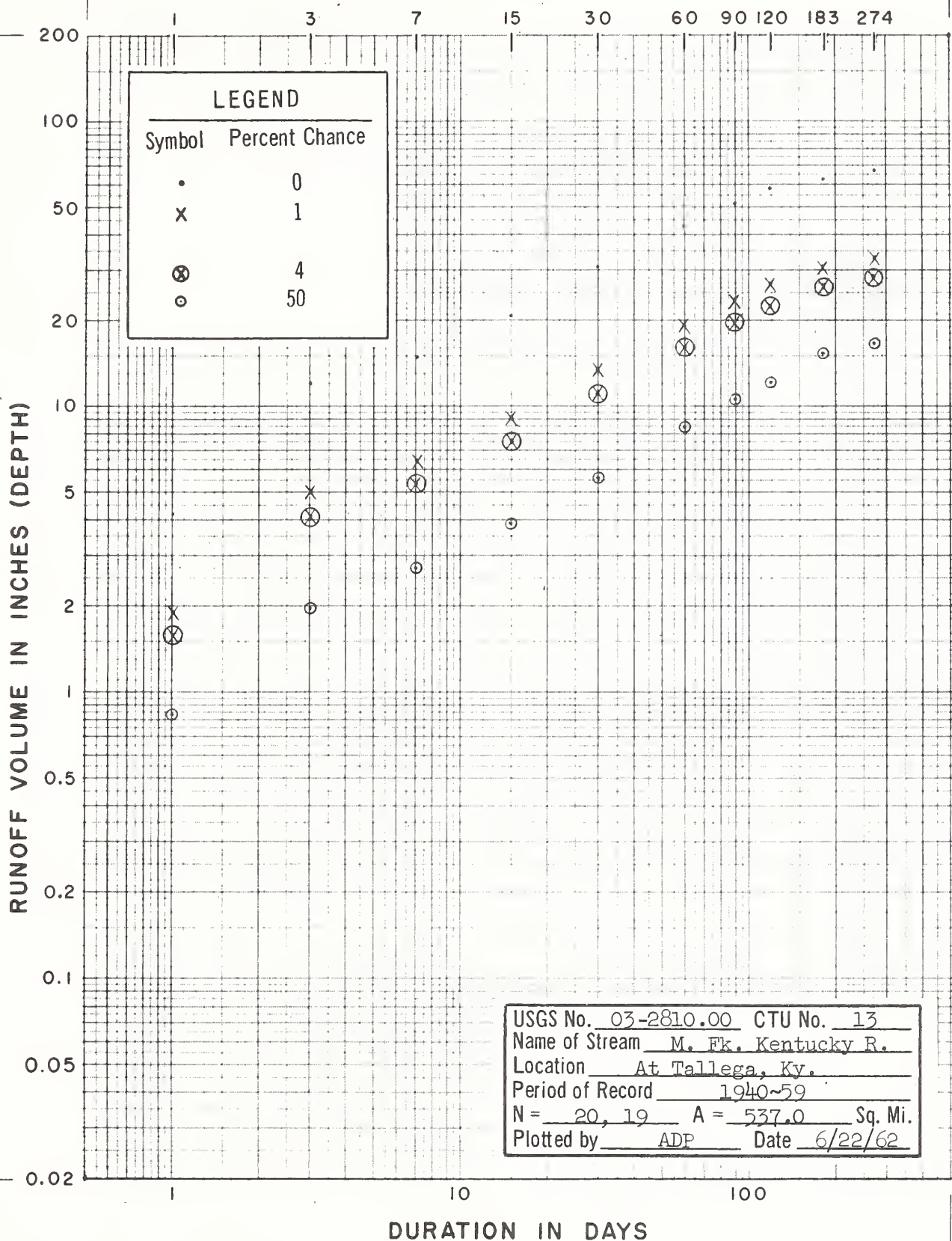
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream M. F. Kentucky River Gage Location at Tallega, Kentucky  
 USGS No. 03-2810.00 CTU No. 13 Drainage Area 537.0 Sq. Mi.  
 Period of Record 1931, 1940-59 Date 6-22-62 N = 21.20 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.045	11.92	14.64	20.88	30.31	43.63	52.66	59.74	67.34	72.05
0.2	2.166	5.950	7.546	10.76	15.65	22.71	27.97	31.74	36.92	39.80
1	1.841	4.949	6.340	9.044	13.17	19.19	23.69	26.87	31.61	34.18
2	1.693	4.497	5.793	8.264	12.04	17.58	21.73	24.65	29.18	31.61
4	1.537	4.025	5.221	7.448	10.86	15.90	19.68	22.33	26.62	28.89
10	1.314	3.357	4.404	6.283	9.171	13.51	16.75	19.01	22.94	24.99
20	1.126	2.797	3.720	5.306	7.758	11.49	14.28	16.20	19.80	21.65
50	.816	1.906	2.612	3.726	5.466	8.189	10.24	11.62	14.61	16.10
80	.569	1.229	1.750	2.496	3.677	5.597	7.053	8.002	10.42	11.60
95	.386	.758	1.133	1.616	2.390	3.707	4.708	5.341	7.259	8.176
99	.267	.472	.744	1.061	1.581	2.499	3.204	3.634	5.176	5.898
$\gamma$	6.385	4.489	5.345	5.340	5.399	5.844	6.067	6.055	7.230	7.549
$\beta$	.1345	.4570	.5235	.7468	1.078	1.198	1.796	2.040	2.123	2.223
$\beta/\gamma$	.3400	.9682	1.210	1.726	2.505	3.606	4.425	5.020	5.707	6.106

Remarks: 1957 appeared as a high outlier and was deleted from the 1-day duration.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

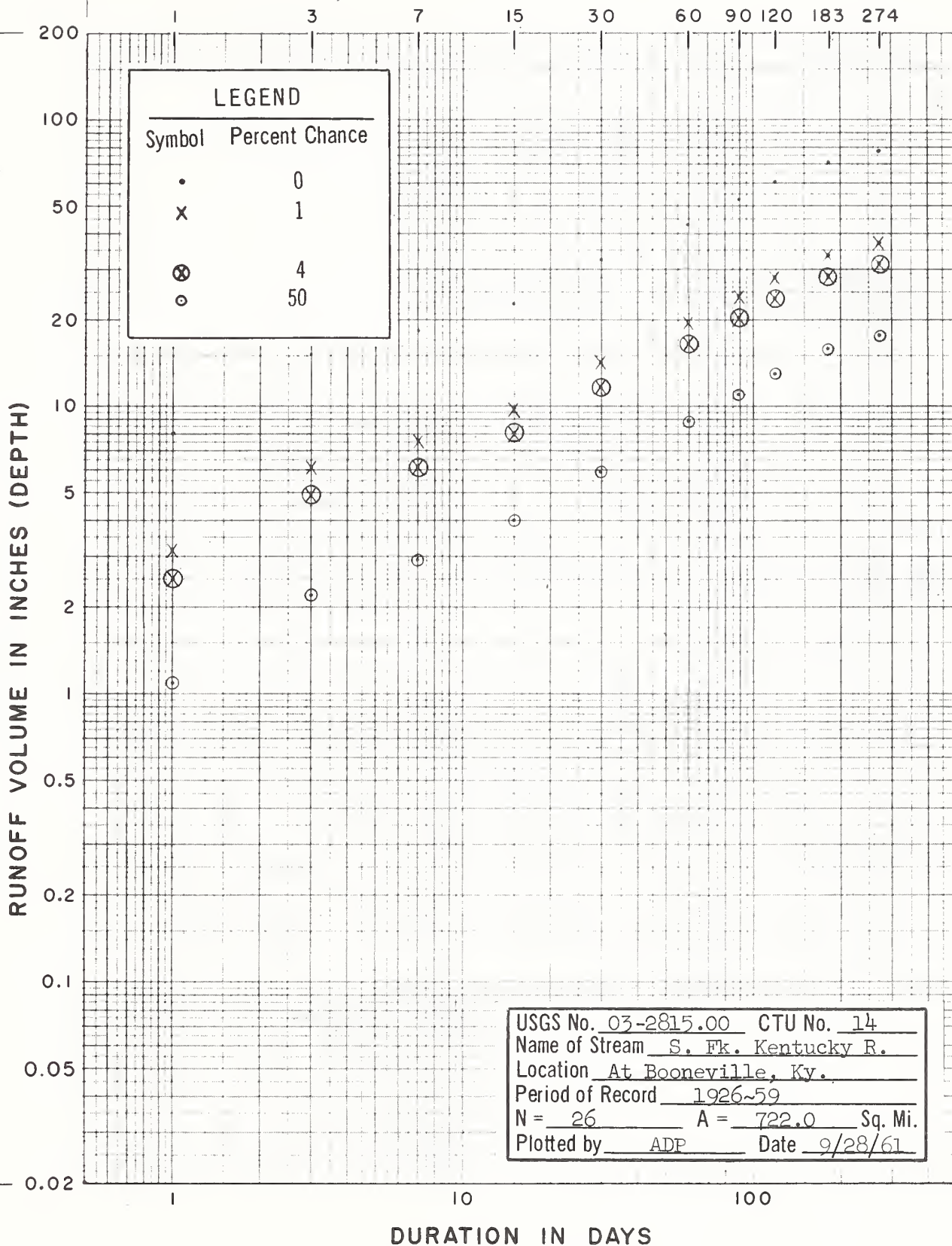
VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream M. F. Kentucky River Gage Location at Talleiga, Kentucky  
 USGS No. 03-2810.00 CTU No. 13 Drainage Area 537.0 Sq. Mi.  
 Period of Record 1940-59 Date 6-22-62 N = 20.19 Years

Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.160	11.98	14.70	20.63	30.64	42.51	51.50	58.25	62.68	67.15
0.2	2.219	6.040	7.622	10.74	15.85	22.67	27.68	31.43	35.71	38.39
1	1.882	5.030	6.426	9.072	13.35	19.23	23.57	26.81	30.93	33.29
2	1.729	4.575	5.882	8.314	12.21	17.67	21.70	24.71	28.72	30.94
4	1.568	4.098	5.312	7.519	11.02	16.02	19.73	22.49	26.39	28.46
10	1.338	3.424	4.499	6.387	9.323	13.67	16.90	19.31	23.04	24.87
20	1.143	2.858	3.816	5.430	7.897	11.68	14.51	16.60	20.14	21.77
50	.824	1.956	2.706	3.872	5.581	8.423	10.56	12.14	15.30	16.59
80	.571	1.268	1.835	2.646	3.770	5.837	7.630	8.571	11.29	12.29
95	.385	.787	1.205	1.753	2.464	3.929	5.064	5.898	8.207	8.970
99	.264	.494	.804	1.182	1.636	2.697	3.536	4.146	6.091	6.686
$\gamma$	6.170	4.563	5.561	5.773	5.513	6.263	6.689	6.724	8.700	9.050
$\beta$	.1408	.4597	.5151	.7094	1.079	1.427	1.673	1.888	1.816	1.908
$\beta/\gamma$	.3496	.9819	1.215	1.705	2.532	3.572	4.328	4.895	5.357	5.739

Remarks: 1957 appeared as a high outlier and was deleted from the 1-day duration.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS



**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream S. F. Kentucky River Gage Location at Booneville, Kentucky  
 USGS No. 03-2815.00 CTU No. 14 Drainage Area 722.0 Sq. Mi.  
 Period of Record 1926-59 Date 9-7-61 N = 26 Years

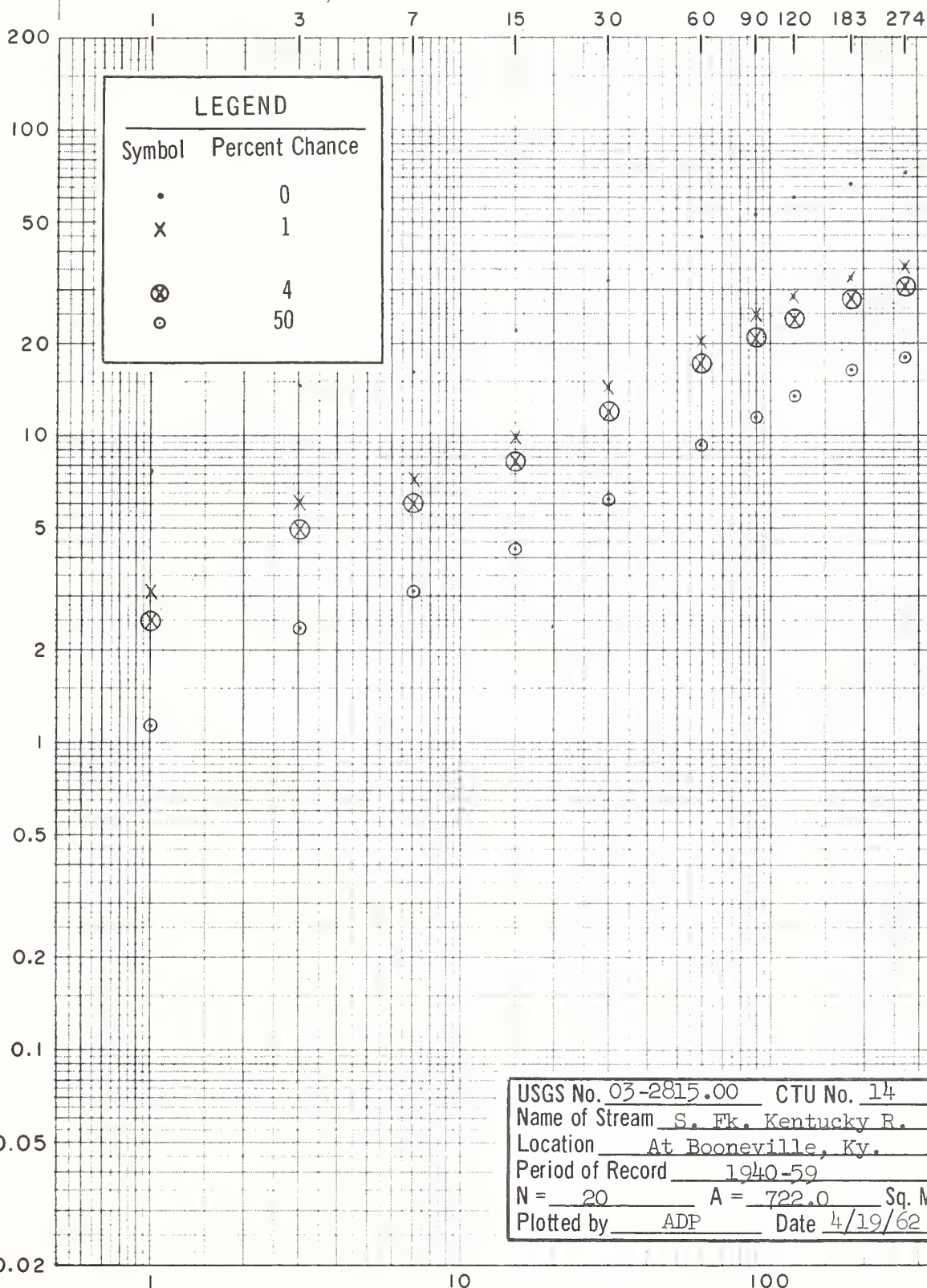
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	7.950	15.08	18.19	22.65	32.38	43.10	52.86	60.79	71.15	78.15
0.2	3.840	7.386	9.080	11.65	16.75	23.17	28.52	33.20	39.30	43.33
1	3.141	6.086	7.552	9.779	14.11	19.73	24.33	28.38	33.76	37.27
2	2.826	5.501	6.863	8.929	12.91	18.16	22.42	26.17	31.22	34.50
4	2.500	4.891	6.142	8.040	11.65	16.51	20.41	23.85	28.53	31.56
10	2.043	4.035	5.123	6.775	9.853	14.14	17.52	20.52	24.68	27.35
20	1.666	3.320	4.268	5.713	8.346	12.14	15.07	17.68	21.38	23.72
50	1.079	2.200	2.909	4.000	5.898	8.841	11.02	12.99	15.90	17.72
80	.649	1.366	1.875	2.668	3.985	6.204	7.778	9.217	11.45	12.82
95	.367	.804	1.157	1.717	2.604	4.238	5.353	6.383	8.074	9.087
99	.207	.474	.720	1.121	1.729	2.959	3.762	4.518	5.825	6.597
γ	3.483	3.868	4.513	5.211	5.501	6.572	6.801	6.998	7.580	7.740
β	.3408	.6182	.6962	.8202	1.141	1.143	1.703	1.947	3.048	2.380
β/γ	.6360	1.216	1.479	1.872	2.676	3.622	4.442	5.152	6.030	6.623

Remarks:



RUNOFF VOLUME IN INCHES (DEPTH)



DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

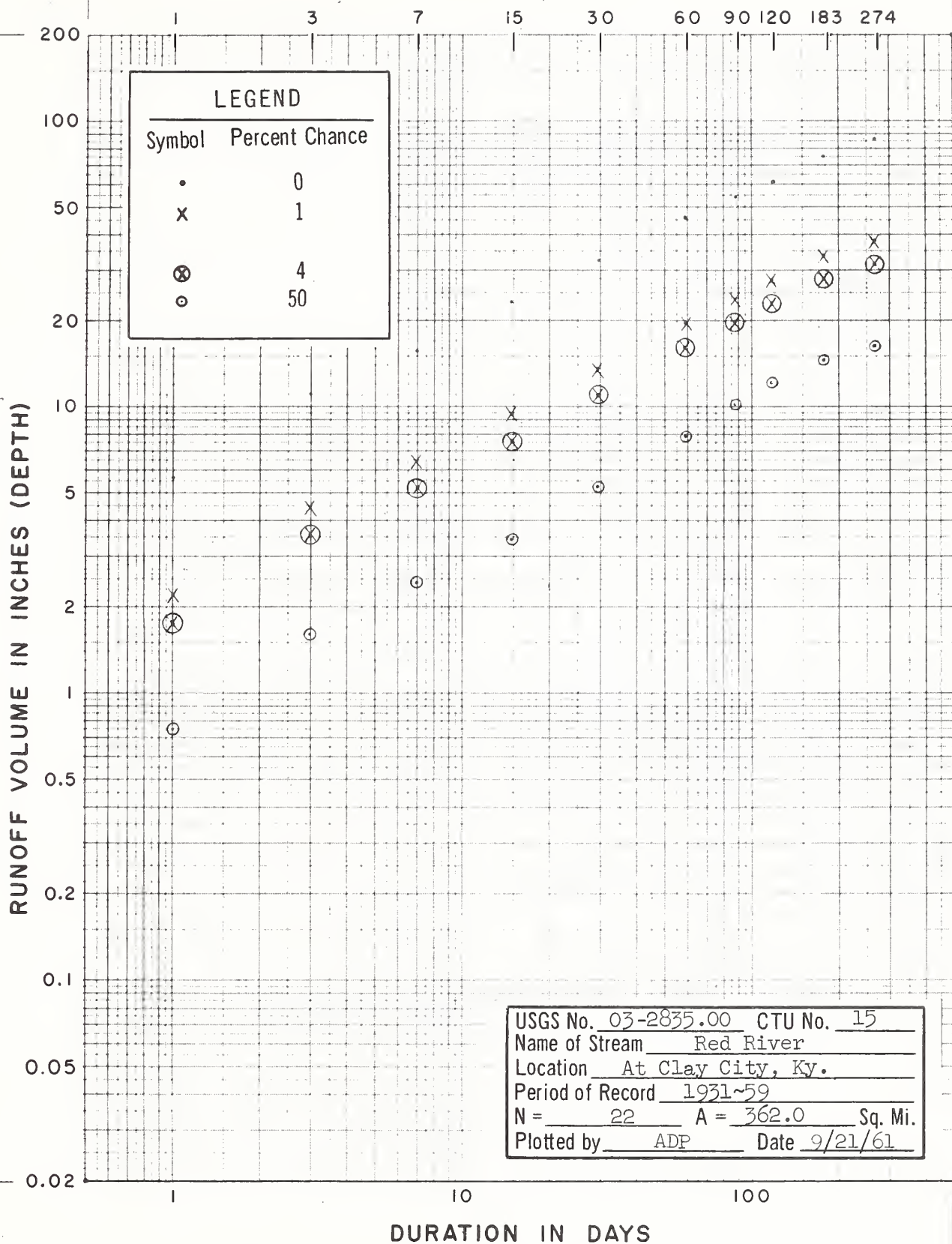
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream S. F. Kentucky River Gage Location at Booneville, Kentucky  
 USGS No. 03-2815.00 CTTU No. 14 Drainage Area 722.0 Sq. Mi.  
 Period of Record 1940-59 Date 4-18-62 N = 20 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	7.594	14.41	15.99	22.00	31.99	44.72	52.99	60.44	66.62	72.55
0.2	3.726	7.264	8.497	11.69	16.99	24.13	29.06	33.39	38.09	41.63
1	3.075	6.050	7.194	9.898	14.39	20.58	24.87	28.67	33.03	36.15
2	2.783	5.502	6.600	9.080	13.20	18.97	22.96	26.52	30.70	33.62
4	2.477	4.929	5.978	8.224	11.96	17.26	20.95	24.24	28.24	30.94
10	2.047	4.118	5.088	7.000	10.18	14.82	18.05	20.96	24.67	27.07
20	1.688	3.438	4.338	5.969	8.677	12.75	15.58	18.16	21.60	23.74
50	1.124	2.353	3.111	4.280	6.223	9.324	11.50	13.51	16.46	18.13
80	.703	1.525	2.142	2.947	4.285	6.580	8.201	9.727	12.20	13.49
95	.417	.947	1.430	1.967	2.860	4.528	5.713	6.858	8.900	9.878
99	.249	.594	.973	1.339	1.946	3.183	4.073	4.948	6.634	7.392
$\gamma$	4.009	4.594	6.021	6.025	6.019	6.854	7.298	7.577	8.983	9.146
$\beta$	.3058	.5508	.5476	.7080	1.095	1.435	1.662	1.861	1.900	2.050
$\beta/\gamma$	.6124	1.181	1.344	1.849	2.688	3.758	4.491	5.122	5.694	6.201

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Red River at Gage Location Clay City, Kentucky  
 USGS No. 03-2835.00 CTU No. 15 Drainage Area 362.0 Sq. Mi.  
 Period of Record 1931, 1939-59 Date 9-1-61 N = 22 Years

**Runoff Volume in Inches (Depth)**

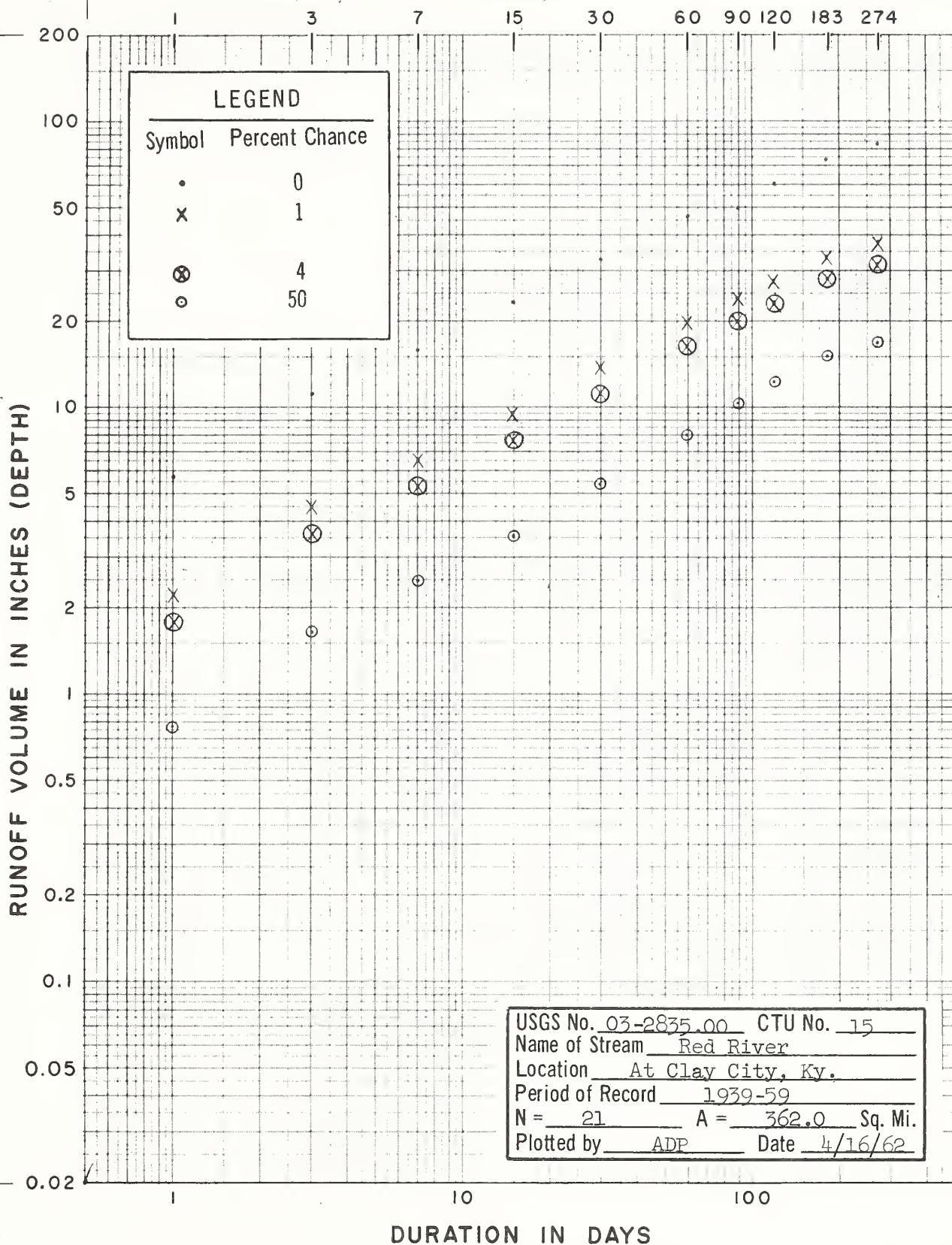
% Probability  
(Greater than)

Duration in Days

	1	3	7	15	30	60	90	120	183	274
0.0	5.613	11.01	15.57	23.19	32.26	45.74	53.95	61.17	74.92	86.09
0.2	2.686	5.392	7.744	11.38	16.26	23.43	28.14	32.62	39.80	44.90
1	2.193	4.443	6.421	9.391	13.55	19.62	23.80	27.67	33.70	37.97
2	1.971	4.016	5.826	8.497	12.32	17.89	21.82	25.42	30.92	34.82
4	1.741	3.570	5.203	7.564	11.04	16.08	19.75	23.05	28.00	31.51
10	1.419	2.945	4.325	6.251	9.220	13.52	16.79	19.67	23.84	26.80
20	1.154	2.423	3.590	5.156	7.697	11.36	14.30	16.81	20.32	22.81
50	.743	1.606	2.426	3.433	5.267	7.896	10.22	12.12	14.58	16.31
80	.443	.997	1.546	2.147	3.413	5.220	7.014	8.399	10.04	11.19
95	.248	.587	.939	1.273	2.120	3.323	4.664	5.654	6.699	7.442
99	.138	.346	.576	.759	1.330	2.143	3.157	3.881	4.558	5.037
γ	3.382	3.912	4.299	4.039	4.633	5.025	5.940	6.155	6.009	5.888
β	.2423	.4488	.6107	.9304	1.228	1.686	1.830	2.072	2.568	2.932
β/γ	.4455	.8877	1.266	1.870	2.644	3.780	4.459	5.140	6.296	7.115

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS



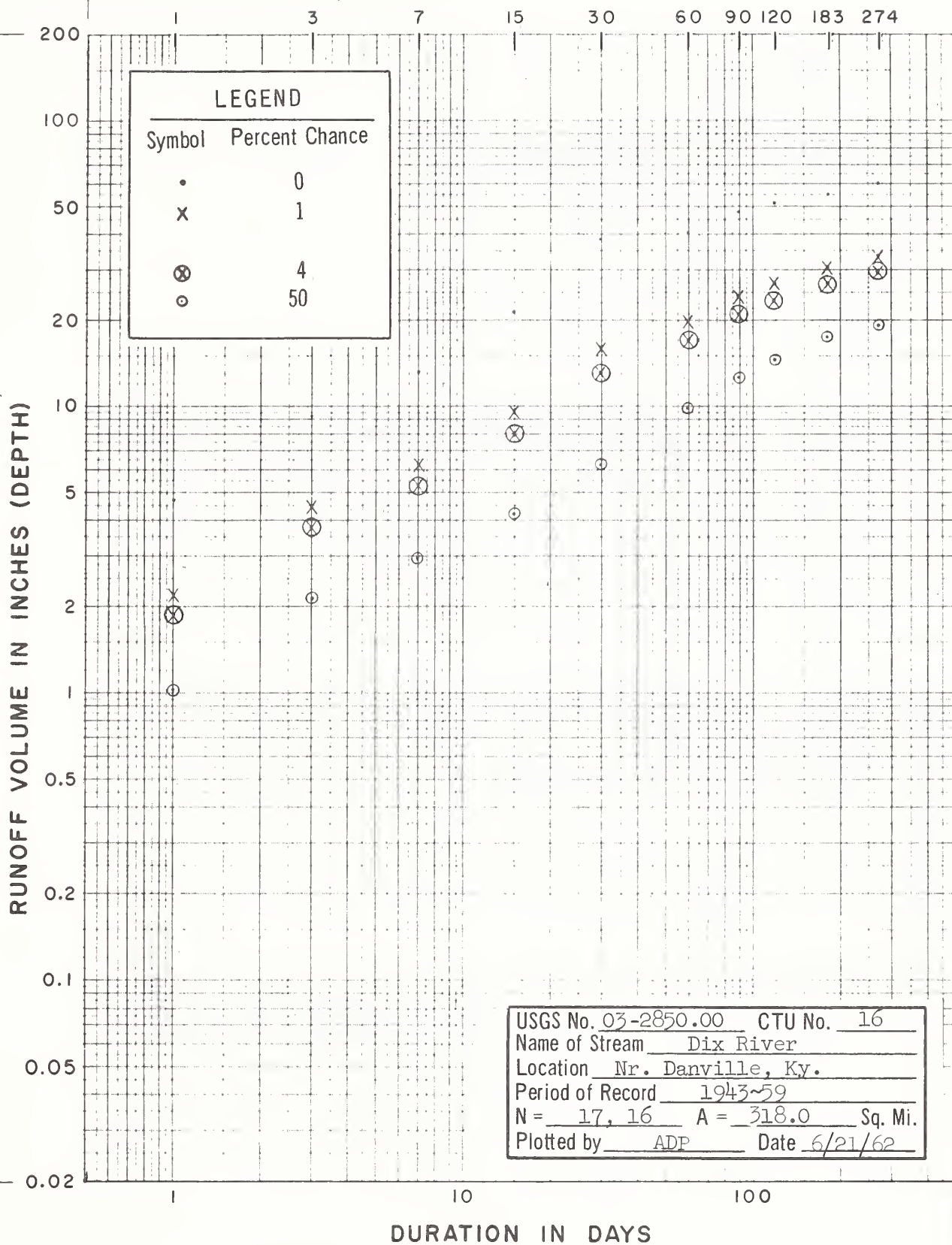
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Red River Gage Location at Clay City, Kentucky  
 USGS No. 03-2835.00 CITU No. 15 Drainage Area 362.0 Sq. Mi.  
 Period of Record 1939-59 Date 4-16-62 N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.646	11.12	15.76	23.22	32.81	46.51	49.85	61.04	73.76	83.40
0.2	2.727	5.455	7.850	11.53	16.57	23.83	28.39	32.68	39.64	44.65
1	2.230	4.503	6.519	9.546	13.82	19.95	24.04	27.78	33.76	37.96
2	2.007	4.074	5.920	8.653	12.58	18.19	22.06	25.54	31.08	34.90
4	1.776	3.627	5.293	7.720	11.28	16.36	19.98	23.19	28.25	31.69
10	1.451	2.997	4.407	6.404	9.438	13.75	17.00	19.83	24.20	27.09
20	1.183	2.472	3.665	5.305	7.892	11.56	14.50	16.99	20.78	23.21
50	.767	1.646	2.488	3.568	5.424	8.030	10.40	12.31	15.13	16.82
80	.461	1.029	1.594	2.260	3.533	5.309	7.159	8.586	10.93	11.73
95	.261	.611	.976	1.363	2.208	3.379	4.778	5.827	7.252	7.961
99	.147	.364	.603	.827	1.396	2.180	3.251	4.031	5.064	5.508
$\gamma$	3.458	4.026	4.396	4.156	4.658	5.045	6.100	6.462	6.517	6.381
$\beta$	.2429	.4468	.6108	.9262	1.246	1.711	1.818	2.018	2.428	2.774
$\beta/\gamma$	.4517	.8966	1.281	1.888	2.689	3.844	4.491	5.129	6.198	7.008

Remarks:



USGS No. 03-2850.00 CTU No. 16  
Name of Stream Dix River  
Location Nr. Danville, Ky.  
Period of Record 1943~59  
N = 17, 16 A = 318.0 Sq. Mi.  
Plotted by ADP Date 6/21/62

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

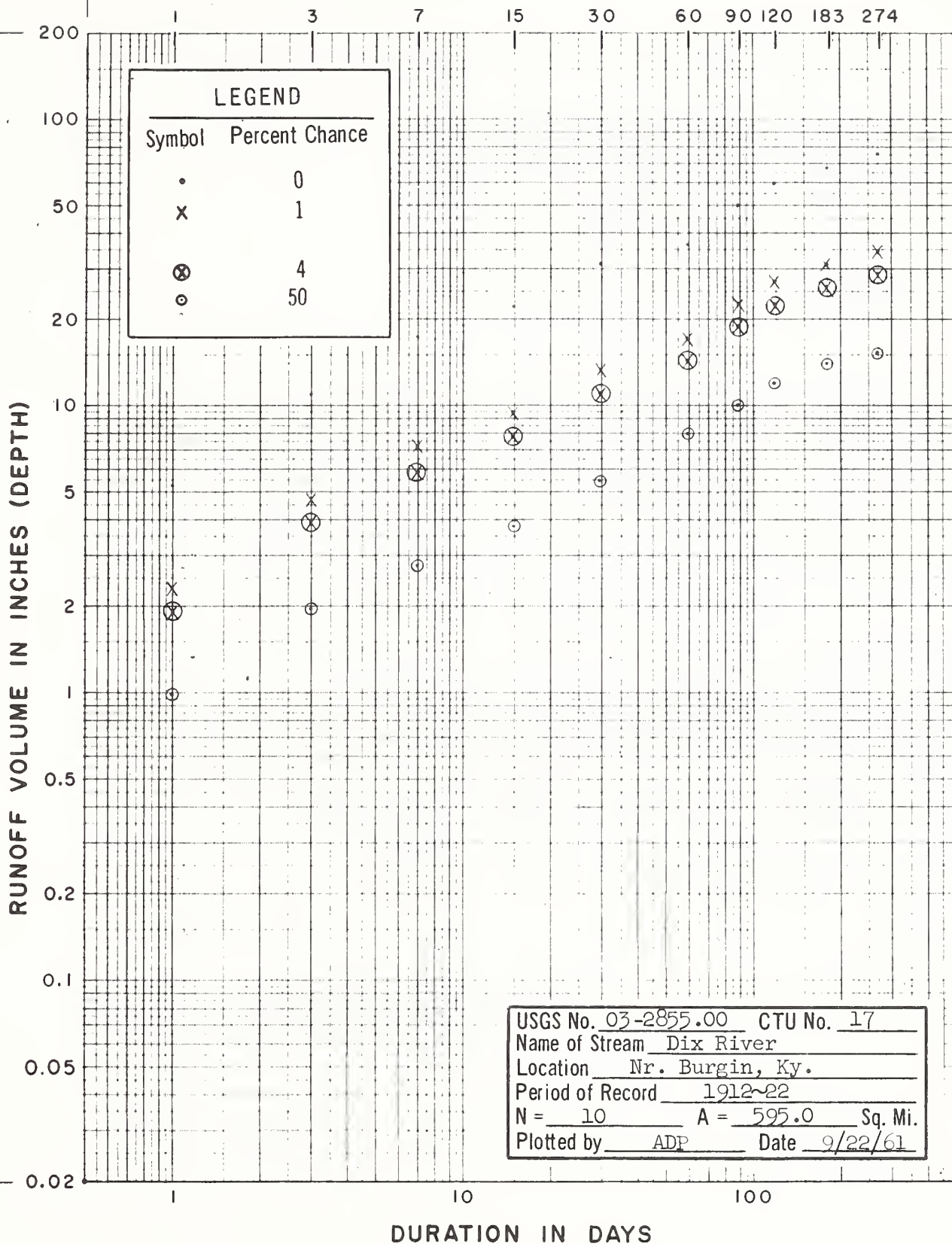
Name of Stream Dix River Gage Location near Danville, Kentucky  
 USGS No. 03-2850.00 CTU No. 16 Drainage Area 318.0 Sq. Mi.  
 Period of Record 1943-59 Date 6-21-62 N = 17,16 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.682	9.201	13.19	21.27	38.26	40.37	47.60	51.48	54.91	60.18
0.2	2.567	5.165	7.287	11.34	19.29	23.00	27.91	30.81	34.44	37.74
1	2.197	4.449	6.259	9.621	16.07	19.92	24.38	27.07	30.62	33.56
2	2.029	4.121	5.788	8.839	14.61	18.50	22.76	25.34	28.83	31.60
4	1.851	3.773	5.290	8.015	13.09	17.00	21.04	23.51	26.92	29.51
10	1.595	3.275	4.576	6.837	10.94	14.84	18.53	20.83	24.15	26.47
20	1.376	2.845	3.963	5.843	9.129	12.97	16.37	18.52	21.72	23.80
50	1.016	2.133	2.948	4.214	6.247	9.854	12.71	14.56	17.52	19.21
80	.725	1.549	2.123	2.920	4.049	7.273	9.630	11.22	13.91	15.25
95	.505	1.105	1.497	1.966	2.515	5.786	7.217	8.554	10.97	12.02
99	.360	.805	1.080	1.349	1.577	3.923	5.513	6.653	8.827	9.675
Y	7.225	8.016	7.694	6.115	4.559	8.745	10.39	11.55	14.63	14.51
B	.1476	.2777	.4031	.7227	1.469	1.167	1.262	1.295	1.227	1.350
B/V	.3968	.7864	1.118	1.787	3.136	3.450	4.068	4.400	4.693	5.144

**Remarks:**

1954 appeared as a low outlier and was deleted from the 60 -274 day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

# VOLUME-DURATION-PROBABILITY ANALYSIS (Two-Parameter Gamma Distribution)

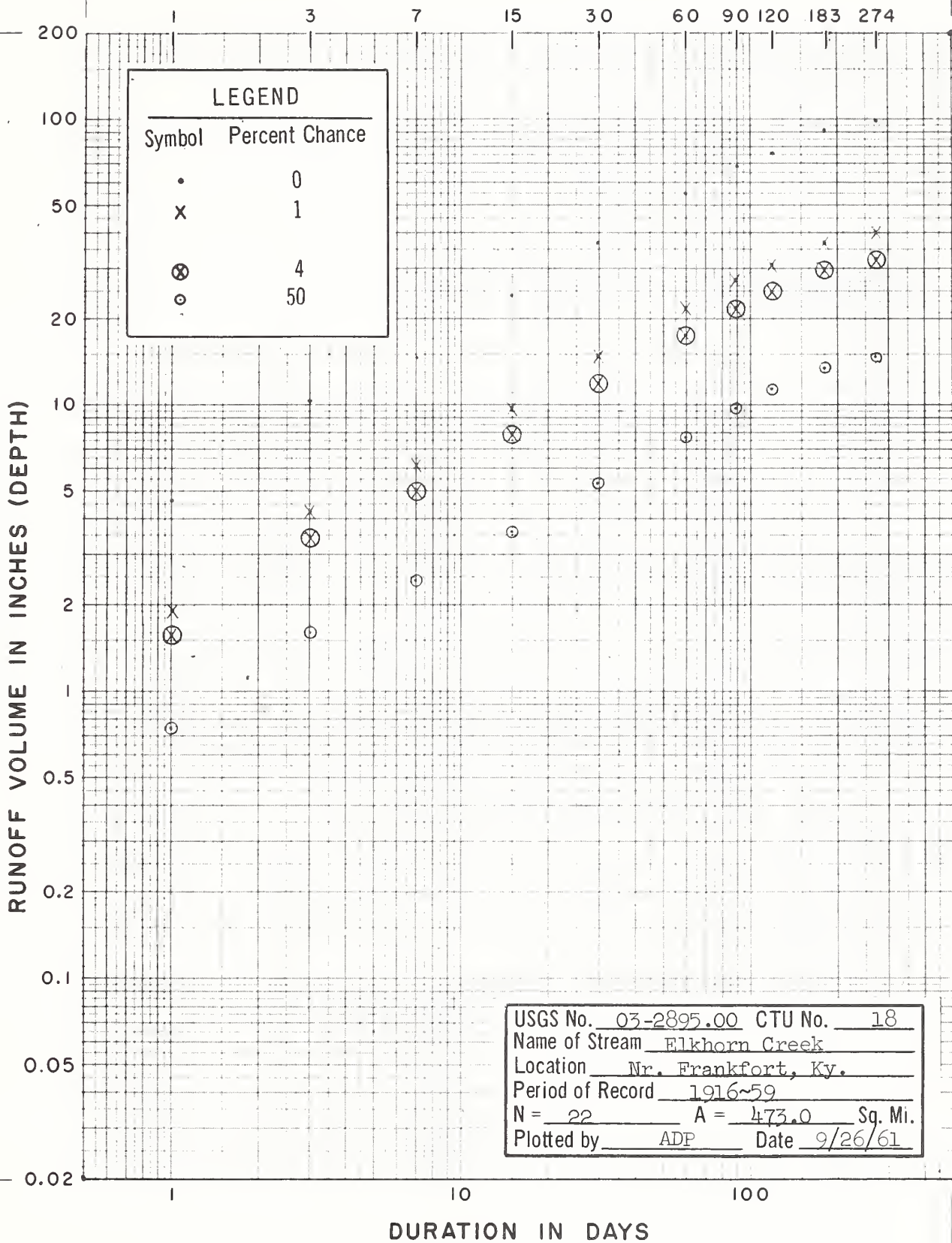
Name of Stream Dix River Gage Location near Burgin, Kentucky  
 USGS No. 03-2855.00 CTU No. 17 Drainage Area 395.0 Sq. Mi.  
 Period of Record 1912-22 Date 9/5/61 N = 10 Years

## Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	7.863	16.40	26.11	33.29	46.94	54.76	75.15	89.71	101.8	114.5
0.2	4.092	8.466	13.03	17.05	24.14	30.14	40.23	48.03	54.92	61.29
1	3.458	7.122	10.84	14.28	20.26	25.84	34.20	40.83	46.86	52.10
2	3.168	6.512	9.851	13.02	18.50	23.88	31.45	37.54	43.18	47.91
4	2.866	5.873	8.817	11.71	16.66	21.80	28.56	34.09	39.30	43.50
10	2.434	4.961	7.354	9.838	14.04	18.82	24.41	29.15	33.74	37.19
20	2.070	4.196	6.127	8.270	11.84	16.28	20.92	24.97	29.02	31.86
50	1.476	2.957	4.176	5.747	8.286	12.06	15.16	18.09	21.22	23.09
80	1.008	1.989	2.692	3.799	5.528	8.646	10.57	12.62	14.98	16.10
95	.6680	1.293	1.618	2.418	3.557	6.061	7.174	8.564	10.31	10.93
99	.4503	.8550	.9999	1.560	2.324	4.349	4.964	5.926	7.246	7.561
$\gamma$	5.816	5.381	4.484	5.010	5.207	7.375	6.442	6.461	6.809	6.408
$\beta$	.2694	.5841	1.003	1.229	1.700	1.709	2.488	2.966	3.279	3.800
$\beta/\gamma$	.6498	1.355	2.123	2.751	3.879	4.641	6.315	7.539	8.555	9.620

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Elkhorn Creek Gage Location near Frankfort, Kentucky  
 USGS No. 03-2895.00 CTU No. 18 Drainage Area 473.0 Sq. Mi.  
 Period of Record 1916-59 Date 9-5-61 N = 22 Years

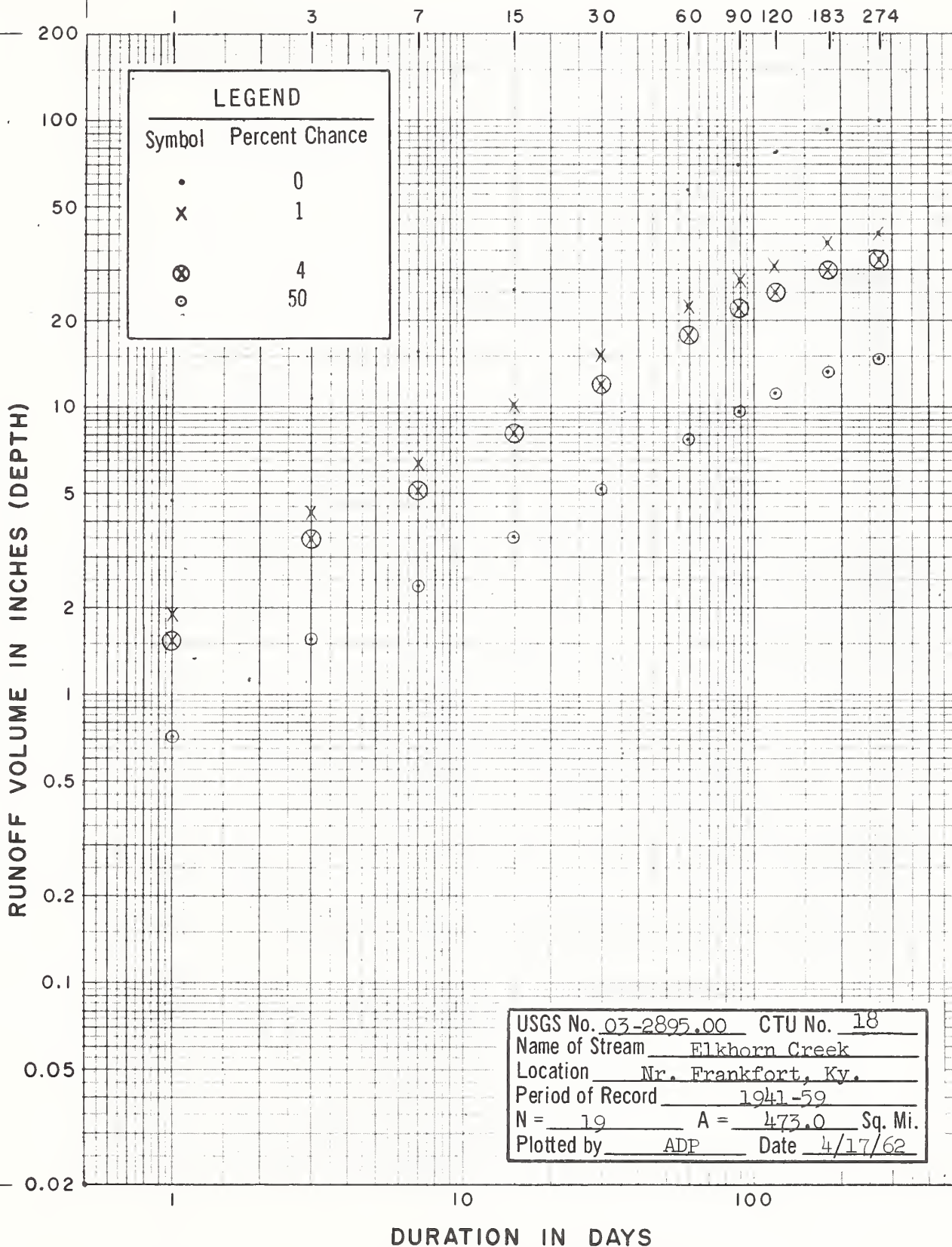
**Runoff Volume in Inches (Depth)**

**Duration in Days**

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	4.594	10.29	14.60	24.07	36.68	54.51	67.85	75.81	91.13	98.36
0.2	2.293	5.118	7.391	11.83	17.97	26.62	33.18	37.26	44.71	48.35
1	1.907	4.244	6.173	9.781	14.80	21.86	27.29	30.81	36.91	39.97
2	1.733	3.850	5.621	8.857	13.38	19.71	24.65	27.90	33.39	36.19
4	1.551	3.439	5.045	7.894	11.90	17.48	21.89	24.87	29.73	32.26
10	1.294	2.858	4.228	6.537	9.815	14.36	18.01	20.59	24.57	26.71
20	1.077	2.373	3.542	5.404	8.075	11.76	14.79	17.02	20.26	22.08
50	.735	1.603	2.443	3.616	5.351	7.711	9.751	11.39	13.49	14.78
80	.474	1.022	1.600	2.275	3.322	4.713	6.008	7.166	8.437	9.296
95	.292	.621	1.007	1.363	1.955	2.721	3.502	4.292	5.005	5.568
99	.182	.381	.640	.819	1.154	1.569	2.047	2.580	2.984	3.347
$\gamma$	4.484	4.316	4.753	4.104	3.894	3.744	3.800	4.076	4.014	4.135
$\beta$	.1764	.4027	.5492	.9583	1.499	2.272	2.807	3.028	3.668	3.901
$\beta/\gamma$	.3735	.8367	1.197	1.941	2.958	4.396	5.472	6.114	7.349	7.932

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Elkhorn Creek Gage Location near, Frankfort, Kentucky  
 USGS No. 03-2895.00 CTU No. 18 Drainage Area 473.0 Sq. Mi.  
 Period of Record 1941-59 Date 4-17-62 N = 19 Years

**Runoff Volume in Inches (Depth)**

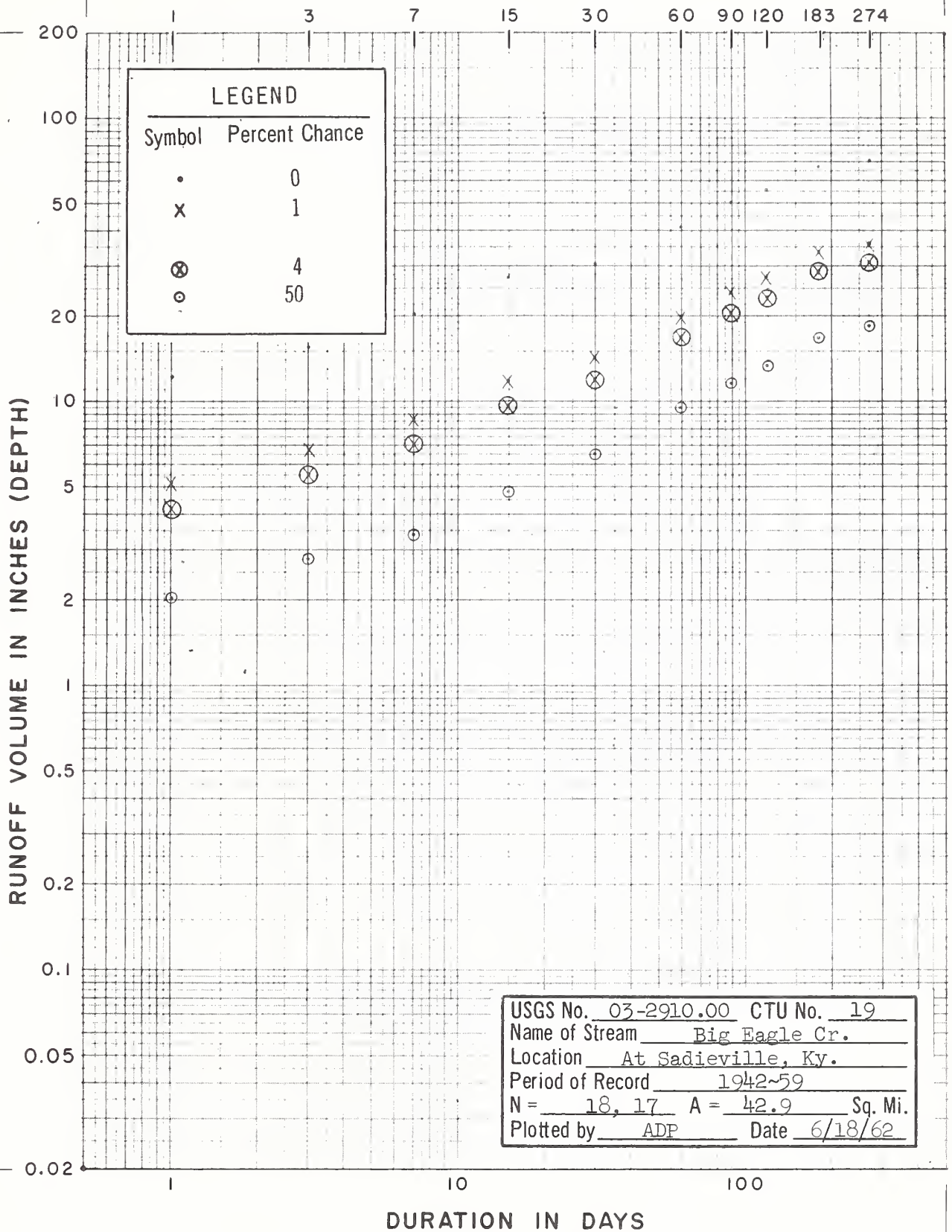
**Duration in Days**

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	4.747	10.73	15.65	25.64	38.63	57.25	69.95	77.52	93.22	100.3
0.2	2.333	5.258	7.767	12.50	18.65	27.65	34.11	37.97	45.59	49.20
1	1.929	4.332	6.431	10.25	15.26	22.62	27.95	31.29	37.50	40.61
2	1.747	3.916	5.830	9.232	13.73	20.35	25.18	28.28	33.86	36.75
4	1.557	3.481	5.201	8.177	12.15	18.00	22.30	25.15	30.07	32.71
10	1.289	2.872	4.315	6.700	9.928	14.72	18.28	20.74	24.75	27.03
20	1.066	2.363	3.574	5.474	8.093	12.00	14.93	17.07	20.32	22.30
50	.713	1.566	2.404	3.569	5.244	7.772	9.736	11.31	13.40	14.85
80	.449	.972	1.523	2.163	3.152	4.672	5.900	7.021	8.255	9.284
95	.269	.572	.918	1.237	1.783	2.643	3.373	4.133	4.812	5.507
99	.162	.338	.557	.705	1.004	1.489	1.924	2.438	2.812	3.283
$\gamma$	4.064	3.866	4.180	3.613	3.504	3.461	3.586	3.888	3.846	3.993
$\beta$	.1899	.4402	.6220	1.088	1.651	2.462	2.979	3.171	3.833	4.047
$\beta/\gamma$	.3828	.8656	1.272	2.068	3.090	4.580	5.641	6.252	7.518	8.087

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS



VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream Big Eagle Creek Gage Location at Sadieville, Kentucky  
 USGS No. 03-2910.00 CTU No. 19 Drainage Area 42.9 Sq. Mi.  
 Period of Record 1942-59 Date 8/25/61 N = 18,17 Years

Runoff Volume in Inches (Depth)

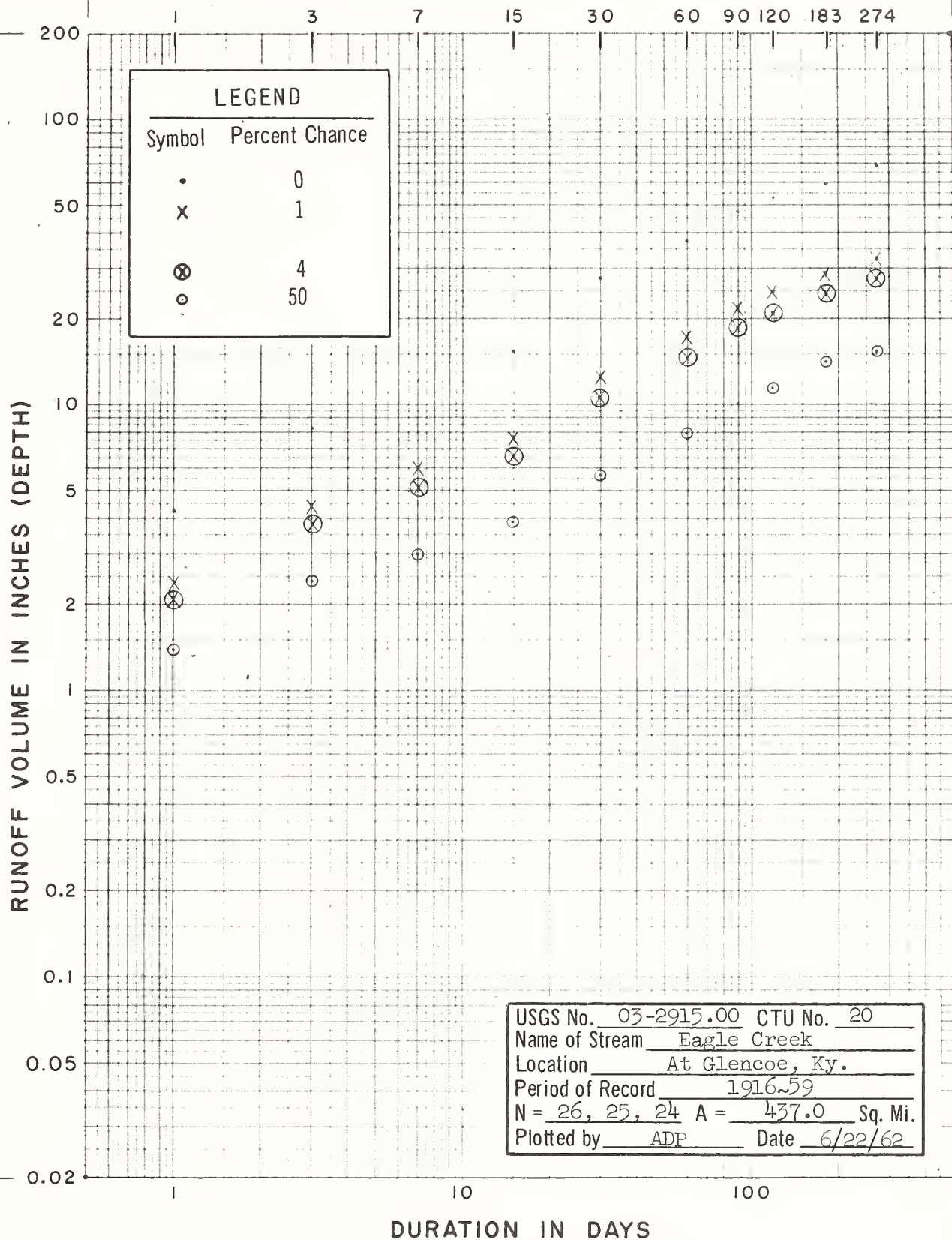
% Probability  
(Greater than)

Duration in Days

	1	3	7	15	30	60	90	120	183	274
0.0	12.17	15.54	20.40	27.37	30.66	41.18	50.36	56.11	67.71	71.28
0.2	6.147	8.022	10.32	14.08	16.74	23.12	28.27	31.85	38.85	41.50
1	5.127	6.749	8.623	11.82	14.31	19.92	24.35	27.55	33.73	36.17
2	4.666	6.171	7.852	10.79	13.20	18.44	22.55	25.57	31.37	33.73
4	4.183	5.565	7.047	9.715	12.03	16.89	20.65	23.48	28.88	31.15
10	3.501	4.701	5.906	8.186	10.35	14.66	17.92	20.46	25.26	27.37
20	2.927	3.977	4.947	6.904	8.914	12.74	15.57	17.87	22.15	24.12
50	2.012	2.802	3.413	4.832	6.550	9.546	11.67	13.53	16.92	18.63
80	1.311	1.885	2.235	3.223	4.648	6.934	8.479	9.952	12.59	14.04
95	.819	1.225	1.406	2.074	3.219	4.946	6.047	7.199	9.219	10.44
99	.518	.810	.895	1.355	2.278	3.604	4.407	5.324	6.898	7.926
Y	4.743	5.379	4.801	5.229	7.034	7.904	8.034	8.546	9.159	10.06
B	.4579	.5538	.7629	.9891	.9796	1.252	1.518	1.641	1.912	1.921
B/V	.9974	1.284	1.672	2.262	2.598	3.520	4.304	4.796	5.787	6.092

Remarks:

1954 appeared as a low outlier and was deleted from the 15-274 day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

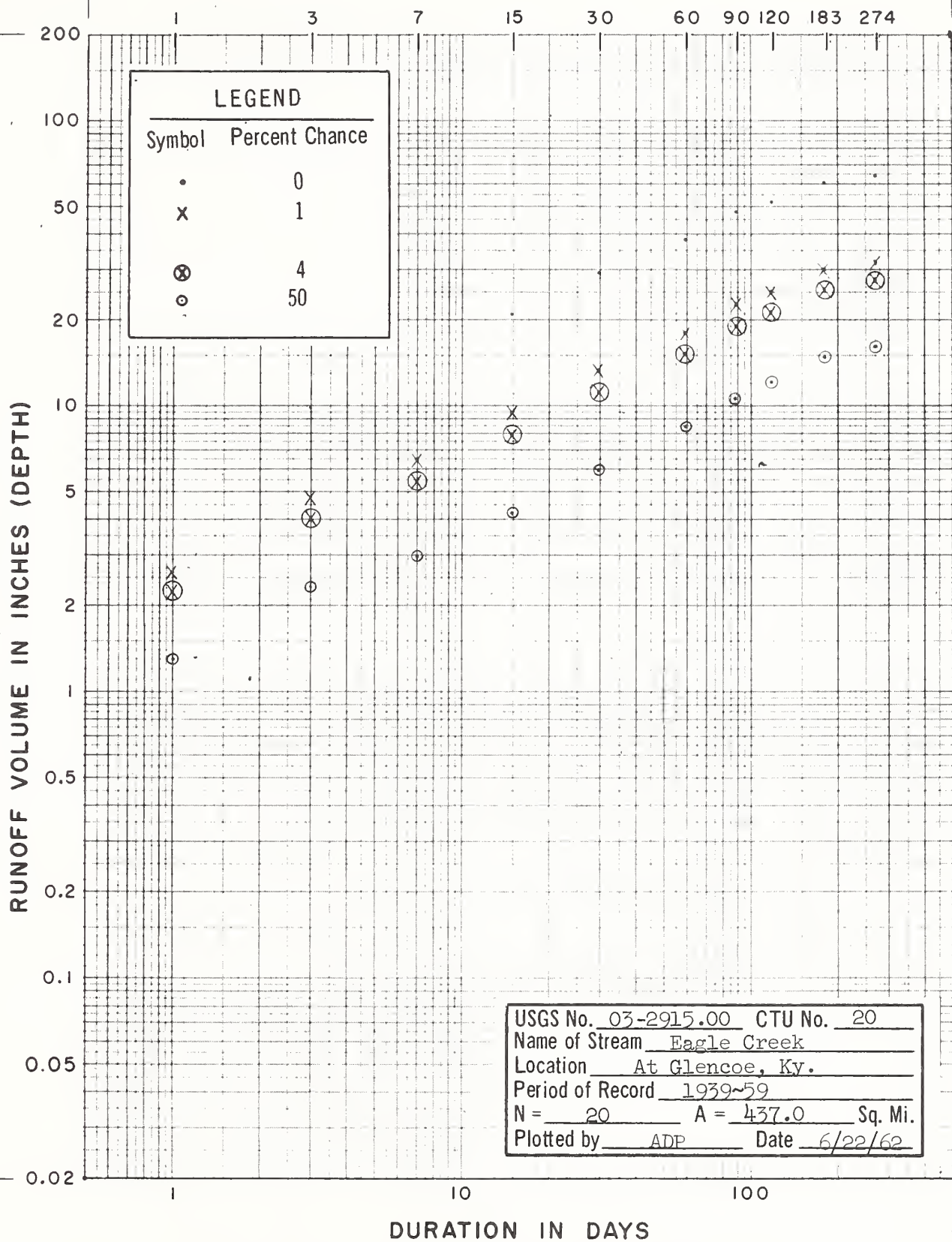
Name of Stream Eagle Creek Gage Location at Glencoe, Kentucky  
 USGS No. 03-2915.00 CTU No. 20 Drainage Area 437.0 Sq. Mi.  
 Period of Record 1916-59 Date 6-22-62 N = 26,25,24 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.223	8.240	12.18	15.30	27.72	37.31	47.38	53.01	58.99	68.89
0.2	2.673	4.995	6.966	8.845	14.90	20.38	25.88	29.06	33.48	38.05
1	2.381	4.405	6.040	7.695	12.69	17.42	22.12	24.88	28.96	32.68
2	2.243	4.131	5.614	7.165	11.68	16.06	20.40	22.97	26.88	30.23
4	2.099	3.838	5.164	6.607	10.62	14.64	18.59	20.95	24.68	27.63
10	1.885	3.415	4.512	5.792	9.097	12.59	15.99	18.06	21.57	23.90
20	1.699	3.045	3.950	5.093	7.808	10.85	13.78	15.58	18.78	20.70
50	1.376	2.414	3.009	3.912	5.686	7.972	10.12	11.50	14.22	15.40
80	1.098	1.876	2.230	2.929	4.107	5.657	7.184	8.203	10.46	11.09
95	.870	1.446	1.627	2.163	2.726	3.918	4.975	5.714	7.567	7.818
99	.704	1.137	1.213	1.631	1.903	2.773	3.522	4.074	5.596	5.640
$\gamma$	15.16	12.41	8.918	9.562	6.659	7.068	6.981	7.207	8.651	7.606
$\beta$	.0927	.1999	.3487	.4229	.9027	1.189	1.520	1.673	1.714	2.117
$\beta/\gamma$	.3610	.7043	1.041	1.308	2.329	3.162	4.016	4.492	5.042	5.838

**Remarks:**

1941 appeared as a low outlier and was deleted from the 1,3, and 7-day durations.  
 1944 appeared as a low outlier and was deleted from the 1 and 3-day durations.  
 1945 appeared as a high outlier and was deleted from the 15-day duration.  
 1954 appeared as a low outlier and was deleted from all durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS



**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Eagle Creek Gage Location at Glencoe, Kentucky  
 USGS No. 03-2915.00 CTD No. 20 Drainage Area 437.0 Sq. Mi.  
 Period of Record 1939-59 Date 6-22-62 N = 20 Years

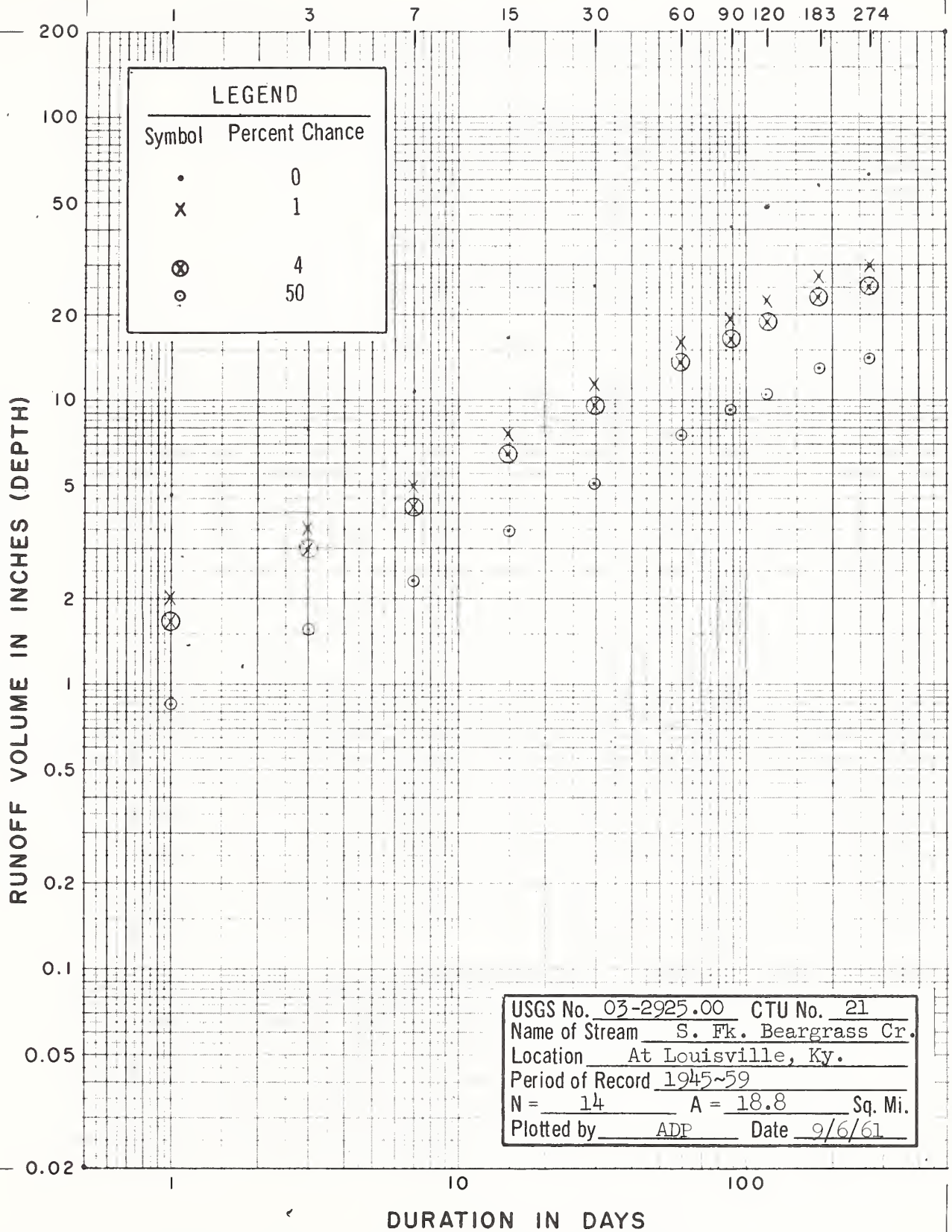
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.264	9.764	13.81	20.85	29.04	37.88	47.52	51.49	60.08	63.65
0.2	2.999	5.521	7.541	11.16	15.61	20.92	26.25	29.01	34.35	36.66
1	2.597	4.770	6.444	9.489	13.29	17.97	22.54	25.03	29.79	31.86
2	2.412	4.425	5.944	8.725	12.23	16.62	20.85	23.20	27.69	29.65
4	2.217	4.059	5.416	7.923	11.12	15.19	19.06	21.26	25.46	27.31
10	1.935	3.532	4.659	6.773	9.528	13.14	16.48	18.48	22.25	23.92
20	1.692	3.079	4.014	5.803	8.179	11.38	14.28	16.09	19.48	21.00
50	1.285	2.324	2.950	4.205	5.956	8.465	10.62	12.10	14.84	16.09
80	.948	1.702	2.093	2.933	4.302	6.096	7.646	8.824	11.00	12.01
95	.689	1.226	1.450	1.990	2.855	4.298	5.392	6.324	8.026	8.835
99	.512	.902	1.026	1.377	1.993	3.101	3.890	4.634	5.982	6.637
$\gamma$	8.753	8.378	7.075	6.428	6.675	7.670	7.643	8.208	9.017	9.478
$\beta$	.1521	.2883	.4397	.6912	.9445	1.159	1.457	1.536	1.710	1.767
$\beta/\gamma$	.4499	.8345	1.170	1.752	2.440	3.210	4.027	4.401	5.135	5.440

Remarks:

1954 appeared as a low outlier and was deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

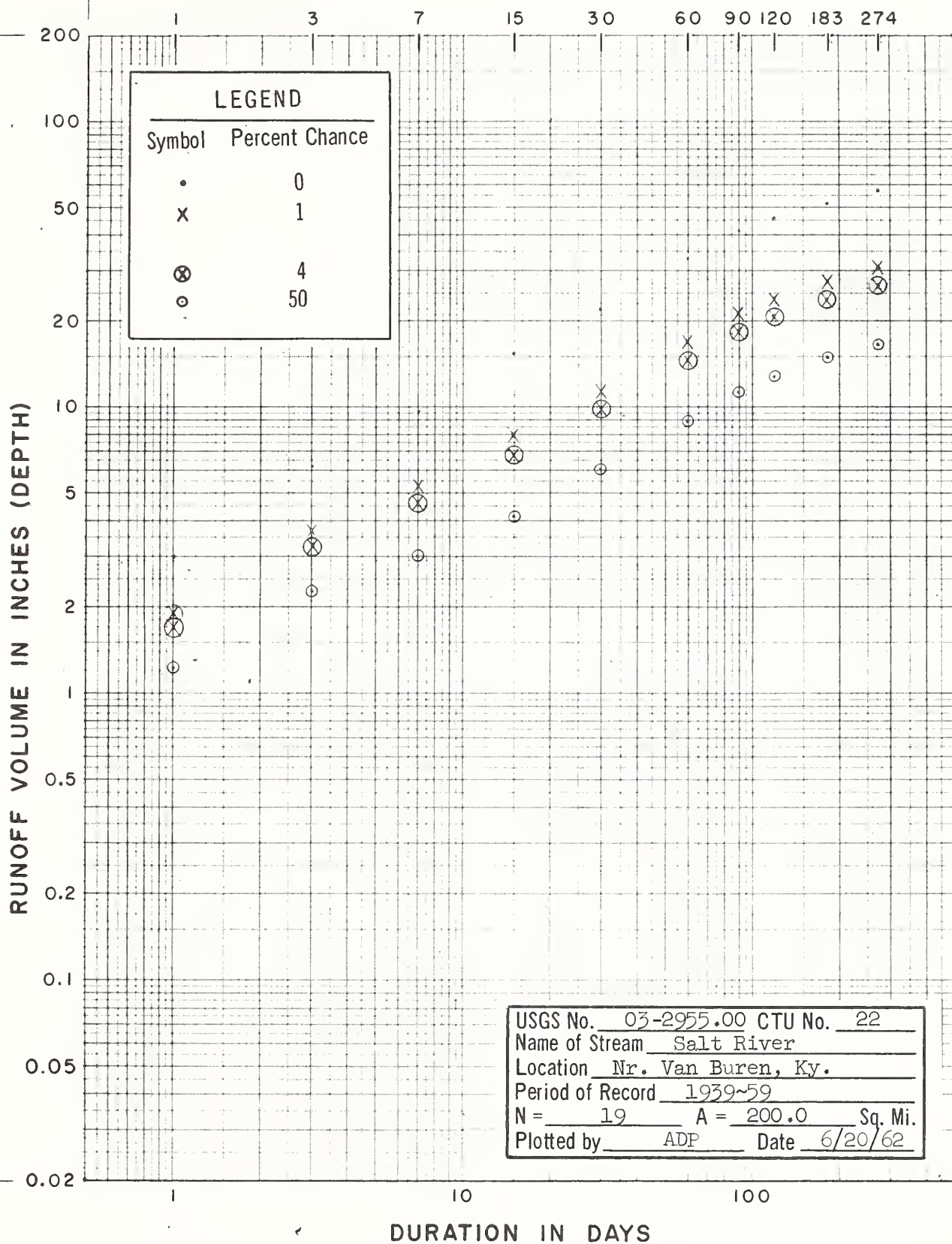
Name of Stream S. F. Beargrass Creek Gage Location at Louisville, Kentucky  
 USGS No. 03-2925.00 CTU No. 21 Drainage Area 18.8 Sq. Mi.  
 Period of Record 1945-59 \* Date 8-25-61 N = 14 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.619	7.874	10.71	16.68	25.35	34.37	40.96	47.91	57.64	62.79
0.2	2.389	4.200	5.875	9.001	13.57	18.92	22.71	26.37	31.96	34.82
1	2.013	3.563	5.029	7.679	11.54	16.22	19.53	22.61	27.49	29.95
2	1.841	3.273	4.643	7.076	10.61	14.99	18.08	20.89	25.45	27.72
4	1.662	2.968	4.235	6.441	9.632	13.69	16.54	19.04	23.28	25.35
10	1.405	2.532	3.650	5.529	8.235	11.82	14.33	16.47	20.17	21.97
20	1.191	2.164	3.150	4.756	7.055	10.22	12.43	14.24	17.50	19.06
50	.841	1.560	2.324	3.478	5.112	7.571	9.285	10.55	13.07	14.23
80	.568	1.081	1.658	2.455	3.566	5.427	6.716	7.564	9.452	10.30
95	.371	.728	1.155	1.689	2.420	3.804	4.762	5.302	6.702	7.300
99	.247	.500	.824	1.187	1.674	2.729	3.457	3.804	4.865	5.300
$\gamma$	5.519	6.263	7.256	6.786	6.322	7.472	7.806	7.465	7.774	7.758
$\beta$	.1625	.2644	.3371	.5382	.8470	1.066	1.242	1.486	1.752	1.910
$\beta/\gamma$	.3817	.6617	.9080	1.402	2.130	2.913	3.471	4.060	4.885	5.321

Remarks:

\*No data in 1954.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Salt River Gage Location near Van Buren, Kentucky  
 USGS No. 03-2955.00 CITU No. 22 Drainage Area 200.0 Sq. Mi.  
 Period of Record 1939~59 Date 8/25/61 N = 19 Years

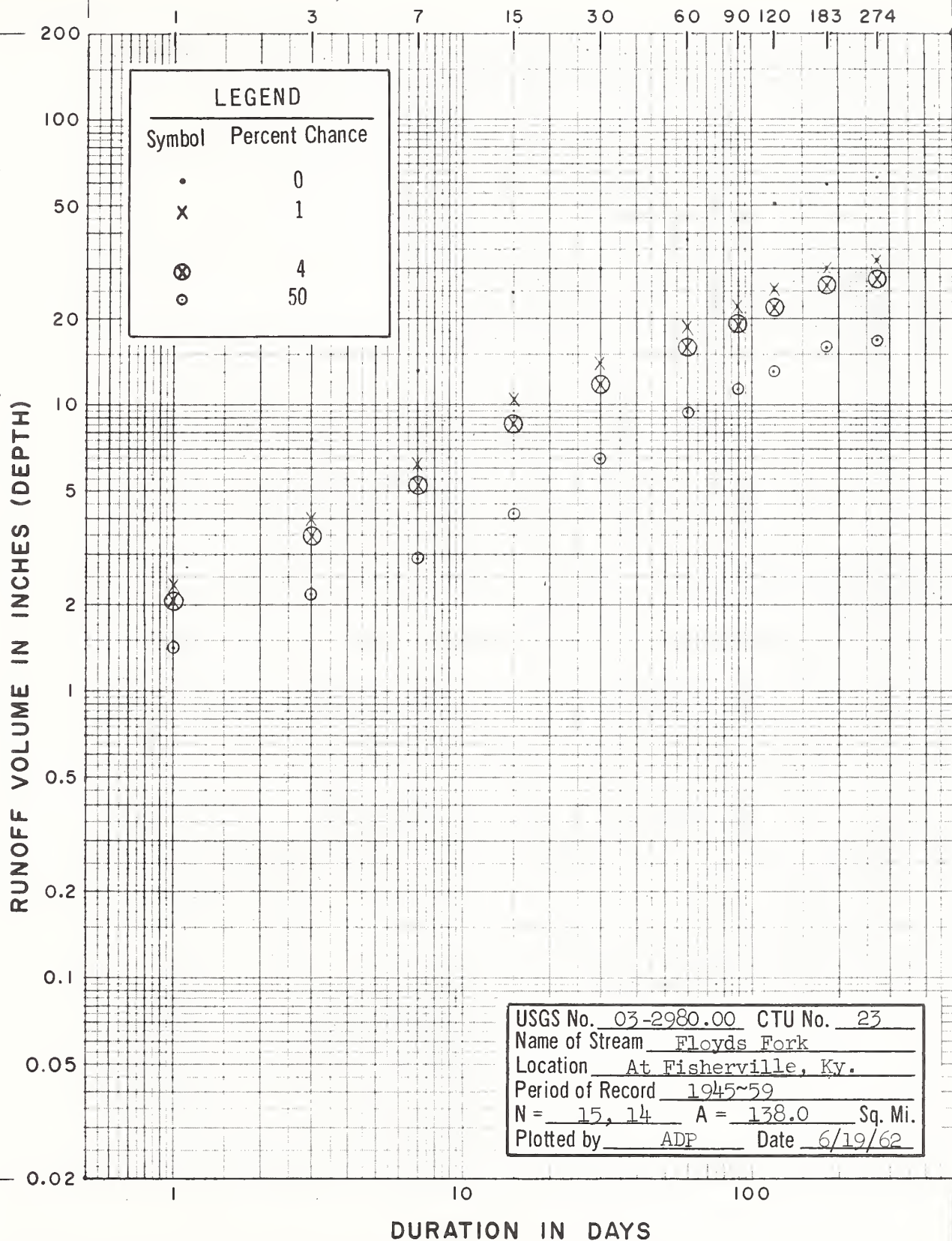
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	2.950	6.178	9.609	15.32	21.87	32.99	41.39	46.05	51.81	57.69
0.2	2.021	4.055	5.972	9.012	13.00	19.42	24.44	27.38	31.21	34.75
1	1.846	3.656	5.301	7.880	11.40	16.98	21.39	24.01	27.47	30.59
2	1.763	3.469	4.985	7.359	10.66	15.85	19.99	22.45	25.74	28.66
4	1.674	3.270	4.649	6.808	9.881	14.67	18.50	20.81	23.90	26.61
10	1.541	2.970	4.162	6.000	8.738	12.93	16.33	18.40	21.22	23.63
20	1.424	2.709	3.735	5.309	7.754	11.44	14.46	16.33	18.89	21.04
50	1.216	2.252	3.000	4.131	6.072	8.900	11.28	12.79	14.92	16.61
80	1.029	1.850	2.369	3.139	4.654	6.762	8.594	9.801	11.54	12.86
95	.870	1.513	1.858	2.360	3.529	5.084	6.482	7.431	8.852	9.851
99	.749	1.264	1.487	1.809	2.729	3.897	4.982	5.747	6.921	7.707
$\gamma$	27.13	19.85	14.04	10.58	11.17	10.58	10.80	11.21	12.06	12.07
$\beta$	.0453	.1155	.2192	.4026	.5594	.8671	1.076	1.176	1.275	1.420
$\beta/\gamma$	.2360	.5148	.8213	1.309	1.869	2.820	3.538	3.936	4.428	4.931

Remarks:

1941 and 1954 appeared as low outliers and were deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream Floyds Fork Gage Location at Fisherville, Kentucky  
 USGS No. 03-2980.00 CTU No. 23 Drainage Area 138.0 Sq. Mi.  
 Period of Record 1945-59 Date 6/19/62 N = 15,14 Years

Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.969	7.545	13.16	24.66	29.84	37.69	43.90	50.74	58.98	62.45
0.2	2.580	4.545	7.241	12.50	16.36	21.63	25.47	29.44	34.71	36.75
1	2.318	4.001	6.208	10.45	14.01	18.78	22.18	25.64	30.35	32.13
2	2.196	3.749	5.737	9.529	12.93	17.46	20.67	23.89	28.34	30.01
4	2.067	3.481	5.238	8.559	11.80	16.07	19.07	22.04	26.22	27.76
10	1.871	3.090	4.522	7.183	10.17	14.06	16.73	19.34	23.11	24.47
20	1.702	2.752	3.910	6.029	8.773	12.33	14.73	17.03	20.45	21.65
50	1.405	2.173	2.898	4.173	6.474	9.418	11.35	13.12	15.91	16.85
80	1.145	1.681	2.077	2.747	4.618	7.006	8.525	9.854	12.09	12.80
95	.929	1.289	1.456	1.738	3.217	5.131	6.318	7.304	9.089	9.624
99	.769	1.008	1.045	1.114	2.294	3.839	4.780	5.525	6.967	7.377
γ	18.33	12.09	7.481	4.929	7.227	9.153	9.780	9.832	10.62	10.58
β	.0779	.1855	.4076	.9104	.9408	1.065	1.200	1.383	1.547	1.641
β/γ	.3335	.6449	1.115	2.021	2.529	3.221	3.752	4.337	5.041	5.338

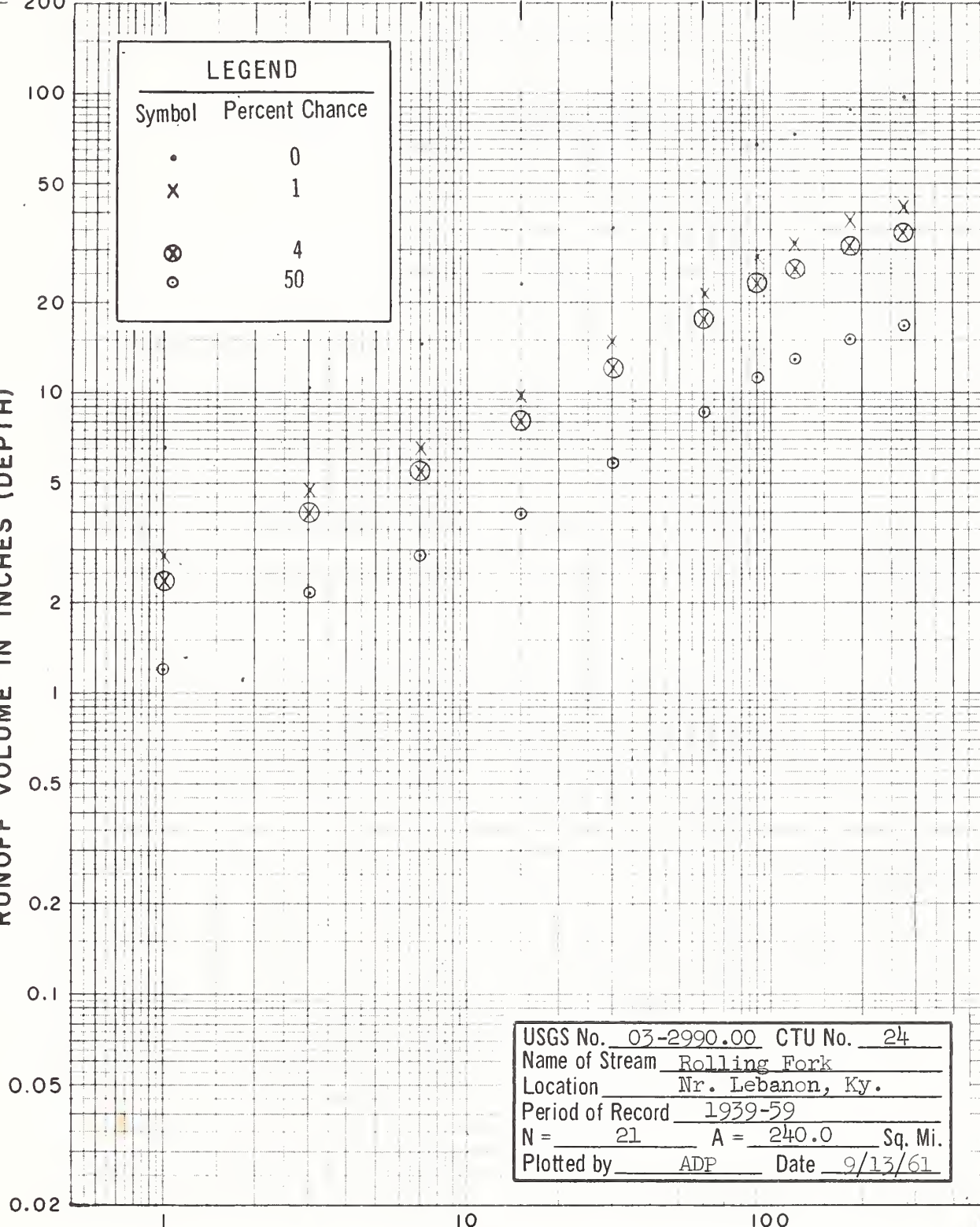
Remarks:

1954 appeared as a low outlier and was deleted from the 30-274 day durations.

RUNOFF VOLUME IN INCHES (DEPTH)

1 3 7 15 30 60 90 120 183 274

LEGEND	
Symbol	Percent Chance
•	0
x	1
⊗	4
⊙	50



DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

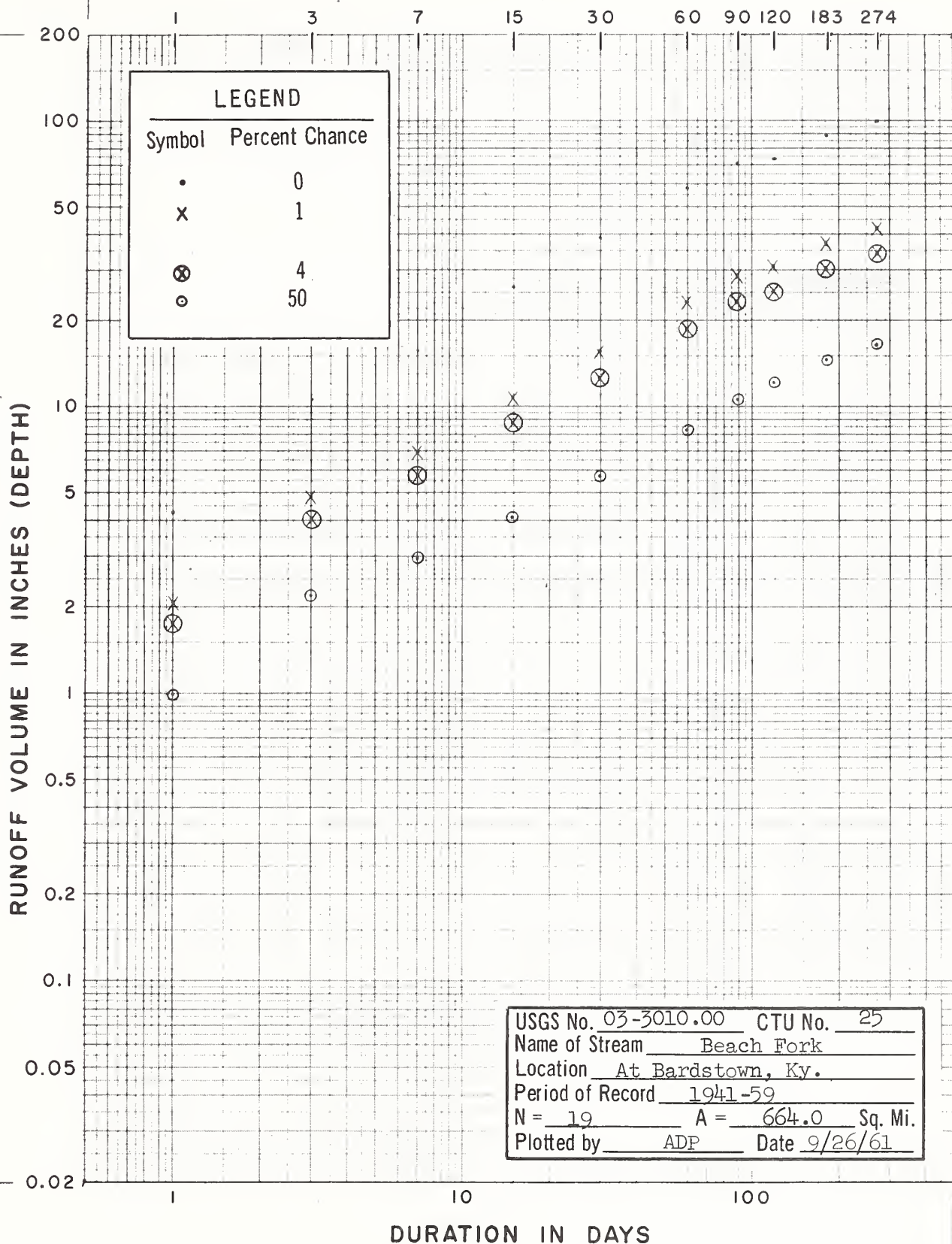
Name of Stream Rolling Fork Gage Location near Lebanon, Kentucky  
 USGS No. 03-2990.00 CTU No. 24 Drainage Area 240.0 Sq. Mi.  
 Period of Record 1939-59 Date 9-1-61 N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.507	10.28	14.45	22.83	35.38	50.05	67.05	72.84	88.20	97.21
0.2	3.367	5.546	7.705	11.70	17.87	25.64	34.00	37.54	45.18	49.80
1	2.836	4.732	6.536	9.794	14.91	21.47	28.43	31.54	37.83	41.70
2	2.594	4.360	6.004	8.931	13.57	19.58	25.91	28.82	34.50	38.02
4	2.341	3.969	5.445	8.029	12.16	17.60	23.28	25.98	31.01	34.18
10	1.980	3.407	4.645	6.748	10.18	14.79	19.53	21.91	26.07	28.73
20	1.677	2.930	3.970	5.672	8.512	12.43	16.39	18.51	21.91	24.15
50	1.185	2.143	2.863	3.942	5.849	8.640	11.35	13.00	15.23	16.78
80	.801	1.513	1.984	2.606	3.811	5.712	7.469	8.705	10.07	11.09
95	.523	1.041	1.335	1.659	2.381	3.636	4.727	5.635	6.407	7.062
99	.347	.732	.917	1.070	1.505	2.345	3.028	3.702	4.133	4.555
$\gamma$	5.505	6.896	6.173	4.969	4.737	4.972	4.874	5.286	4.984	4.958
$\beta$	.2292	.3290	.4886	.8467	1.332	1.855	2.489	2.618	3.265	3.608
$\beta/\gamma$	.5378	.8639	1.214	1.887	2.900	4.136	5.496	6.020	7.289	8.034

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

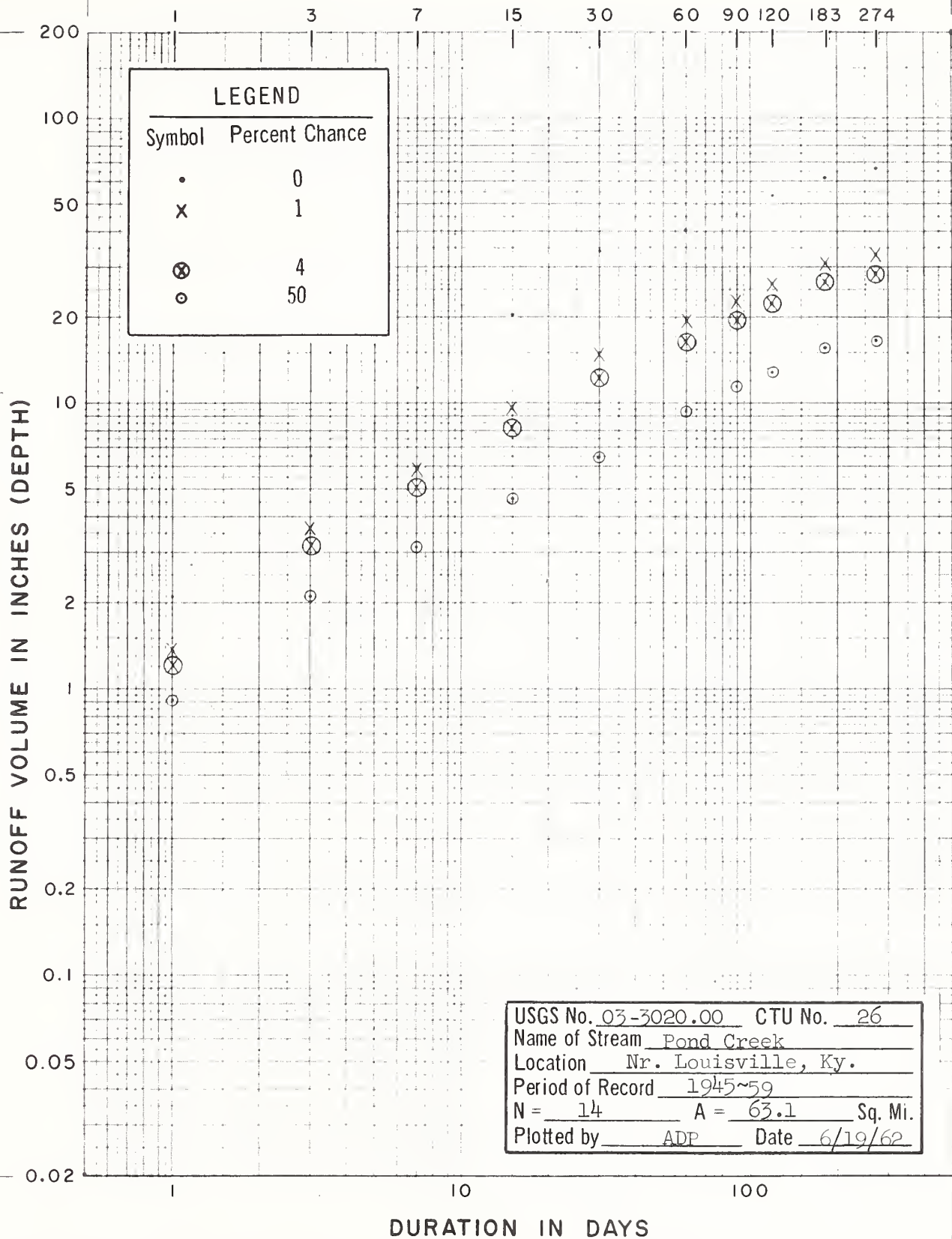
# VOLUME-DURATION-PROBABILITY ANALYSIS (Two-Parameter Gamma Distribution)

Name of Stream Beach Fork Gage Location at Bardstown, Kentucky  
 USGS No. 03-3010.00 CTU No. 25 Drainage Area 664.0 Sq. Mi.  
 Period of Record 1941-59 Date 9-6-61 N = 19 Years

## Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.269	10.59	15.72	26.16	38.86	57.93	71.00	73.46	89.04	99.92
0.2	2.397	5.716	8.197	13.03	19.07	28.33	34.90	37.18	44.98	50.47
1	2.065	4.876	6.933	10.82	15.74	23.30	28.85	31.05	37.51	42.10
2	1.912	4.493	6.357	9.829	14.24	21.04	26.13	28.27	34.14	38.31
4	1.751	4.090	5.753	8.789	12.68	18.69	23.29	25.38	30.61	34.35
10	1.519	3.511	4.892	7.317	10.48	15.38	19.29	21.27	25.62	28.75
20	1.320	3.020	4.165	6.085	8.640	12.63	15.94	17.82	21.42	24.04
50	.990	2.209	2.979	4.131	5.754	8.326	10.67	12.29	14.72	16.52
80	.719	1.559	2.043	2.646	3.598	5.130	6.711	8.050	9.590	10.76
95	.513	1.073	1.359	1.621	2.134	2.990	4.020	5.064	5.992	6.724
99	.374	.754	.920	1.002	1.272	1.747	2.416	3.221	3.788	4.251
γ	7.915	6.748	5.890	4.431	4.049	3.830	4.091	4.821	4.687	4.678
β	.1297	.3427	.5353	1.011	1.557	2.387	2.831	2.742	3.371	3.787
β/γ	.3649	.8903	1.299	2.127	3.134	4.672	5.726	6.021	7.298	8.190

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Pond Creek Gage Location near Louisville, Kentucky  
 USGS No. 03-3020.00 CTU No. 26 Drainage Area 63.1 Sq. Mi.  
 Period of Record 1945-59 Date 6/22/62 N = 14 Years

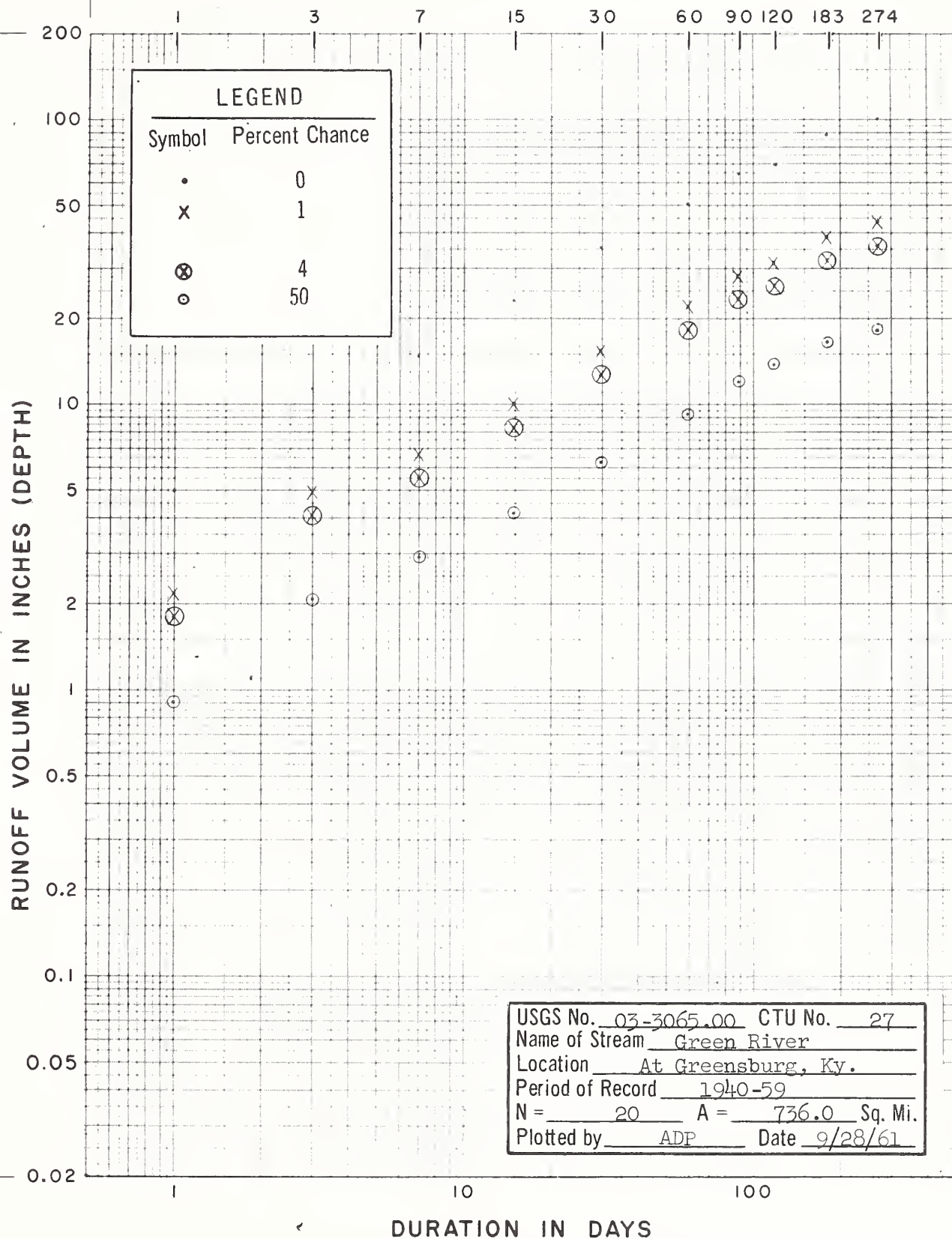
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	2.105	6.568	11.37	20.53	34.24	40.67	46.12	53.84	62.42	67.22
0.2	1.476	4.132	6.758	11.38	17.86	22.83	26.47	30.56	35.95	38.57
1	1.355	3.677	5.926	9.793	15.10	19.67	22.98	26.44	31.24	33.49
2	1.296	3.463	5.542	9.064	13.85	18.21	21.37	24.54	29.08	31.74
4	1.234	3.235	5.136	8.291	12.53	16.68	19.67	22.53	26.79	28.67
10	1.141	2.903	4.542	7.184	10.66	14.47	17.21	19.64	23.46	25.08
20	1.058	2.613	4.031	6.233	9.073	12.58	15.09	17.14	20.60	21.99
50	.911	2.111	3.156	4.655	6.489	9.427	11.53	12.98	15.78	16.80
80	.779	1.679	2.419	3.367	4.452	6.848	8.574	9.549	11.78	12.50
95	.664	1.326	1.834	2.387	2.960	4.884	6.280	6.908	8.664	9.152
99	.577	1.069	1.418	1.733	2.004	3.559	4.697	5.108	6.509	6.848
$\gamma$	30.36	14.79	11.13	7.713	5.854	8.069	9.236	8.677	9.361	9.248
$\beta$	.0303	.1460	.2912	.6263	1.169	1.224	1.297	1.562	1.744	1.889
$\beta/\gamma$	.1671	.5614	.9715	1.740	2.830	3.476	3.942	4.602	5.335	5.745

Remarks:

1954 appeared as a low outlier and was deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

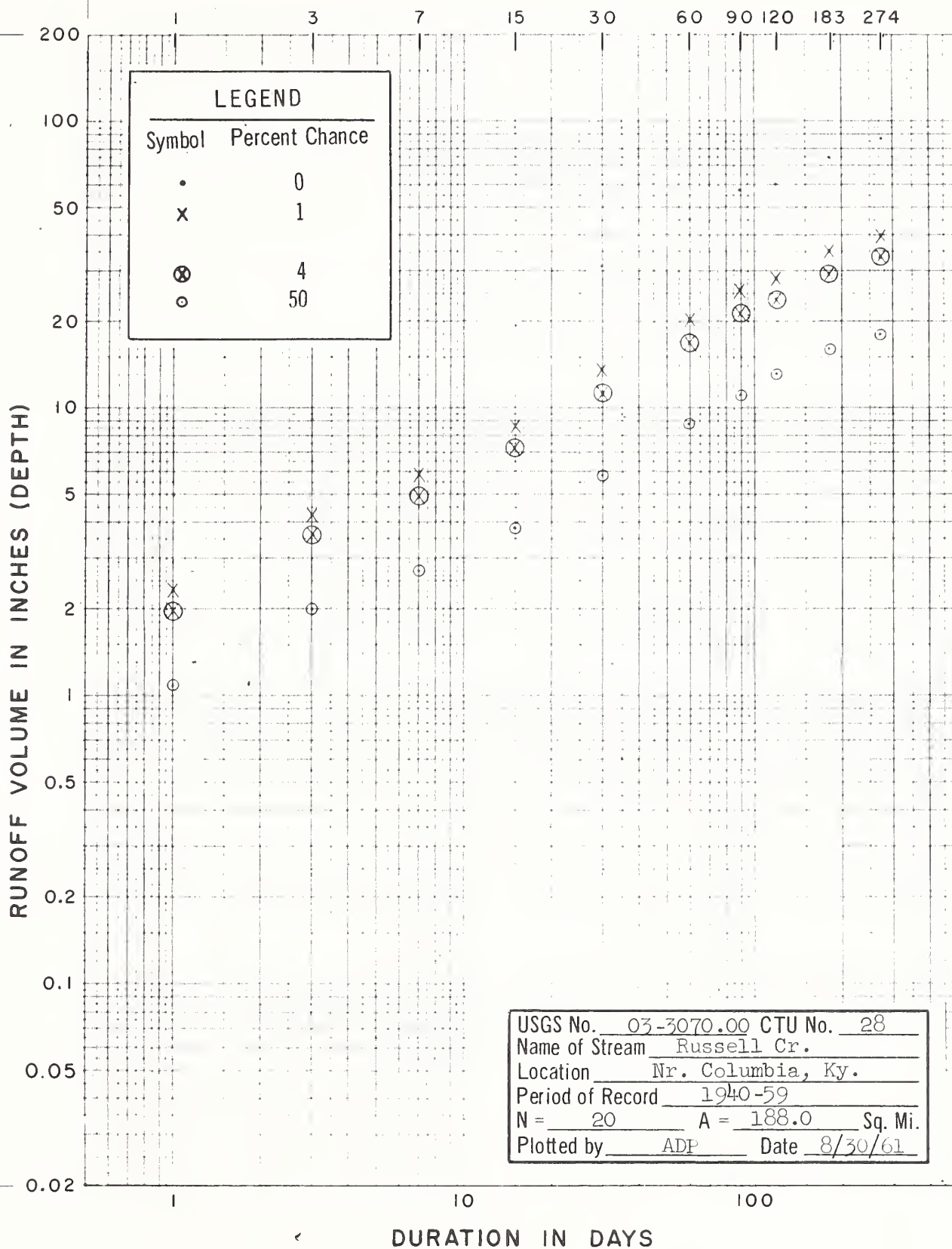
Name of Stream Green River Gage Location at Greensburg, Kentucky  
 USGS No. 03-3065.00 CTU No. 27 Drainage Area 736.0 Sq. Mi.  
 Period of Record 1940-59 Date 9-7-61 N = 20 Years

Runoff Volume in Inches (Depth)

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	4.943	11.23	14.61	23.00	35.43	50.43	64.58	69.35	88.03	100.7
0.2	2.557	5.821	7.794	11.88	18.22	26.09	33.54	36.99	45.81	51.99
1	2.154	4.908	6.612	9.992	15.30	21.98	28.31	31.38	38.71	43.74
2	1.970	4.492	6.074	9.136	13.97	20.10	25.93	28.83	35.47	39.99
4	1.778	4.057	5.508	8.239	12.58	18.14	23.43	26.14	32.08	36.06
10	1.504	3.436	4.698	6.960	10.60	15.35	19.87	22.30	27.25	30.46
20	1.274	2.915	4.016	5.887	8.936	13.00	16.88	19.06	23.17	25.77
50	.900	2.067	2.896	4.148	6.254	9.186	12.00	13.74	16.52	18.16
80	.608	1.401	2.007	2.791	4.172	6.206	8.171	9.523	11.29	12.22
95	.397	.921	1.351	1.814	2.685	4.055	5.390	6.411	7.479	7.938
99	.264	.614	.927	1.200	1.754	2.693	3.618	4.400	5.042	5.251
$\gamma$	5.537	5.630	6.184	5.386	5.201	5.488	5.686	6.283	5.767	5.427
$\beta$	.1736	.3881	.4937	.8192	1.284	1.779	2.238	2.325	3.029	3.572
$\beta/\gamma$	.4085	.9280	1.228	1.901	2.928	4.168	5.337	5.828	7.275	8.321

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

# VOLUME-DURATION-PROBABILITY ANALYSIS (Two-Parameter Gamma Distribution)

Name of Stream Russell Creek Gage Location near Columbia, Kentucky  
 USGS No. 03-3070.00 CTU No. 28 Drainage Area 188.0 Sq. Mi.  
 Period of Record 1940-59 Date 8-30-61 N = 20 Years

## Runoff Volume in Inches (Depth)

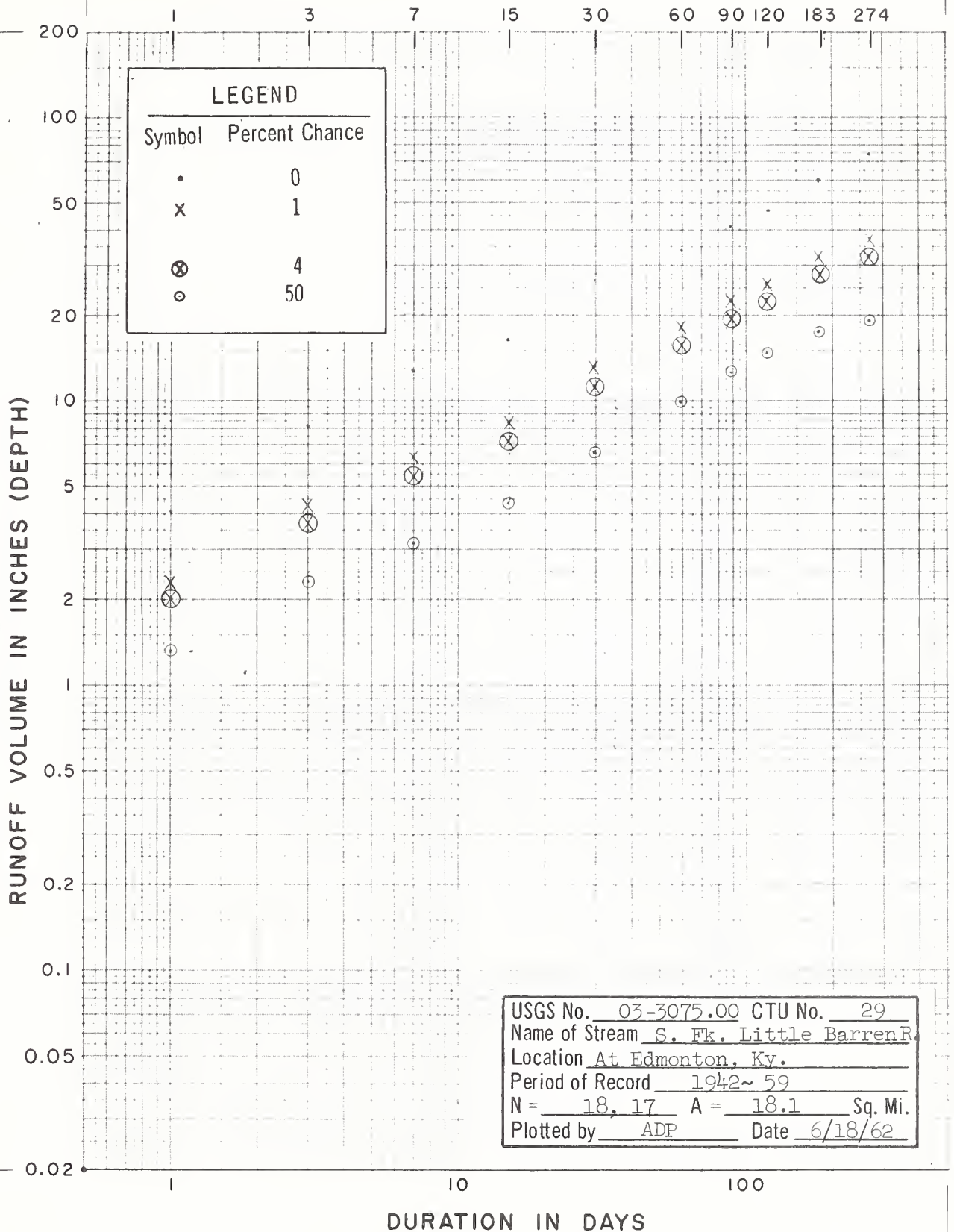
### Duration in Days

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	4.944	9.071	12.56	19.35	31.22	45.42	57.85	60.35	75.40	87.07
0.2	2.711	4.992	6.884	10.32	16.25	24.13	30.73	33.21	41.18	46.98
1	2.320	4.280	5.892	8.754	13.73	20.43	26.02	28.47	35.20	40.08
2	2.142	3.955	5.440	8.042	12.58	18.75	23.87	26.31	32.46	36.93
4	1.954	3.611	4.962	7.293	11.38	16.98	21.62	24.03	29.58	33.61
10	1.684	3.118	4.277	6.221	9.665	14.45	18.40	20.74	25.44	28.86
20	1.454	2.696	3.691	5.317	8.217	12.32	15.69	17.93	21.92	24.82
50	1.073	1.998	2.724	3.834	5.859	8.836	11.25	13.29	16.11	18.15
80	.765	1.432	1.943	2.657	4.004	6.084	7.748	9.527	11.43	12.81
95	.533	1.004	1.353	1.789	2.652	4.061	5.172	6.679	7.917	8.817
99	.380	.720	.965	1.228	1.788	2.764	3.519	4.792	5.604	6.197
$\gamma$	7.211	7.313	7.251	6.179	5.771	5.990	6.041	7.491	7.063	6.731
$\beta$	.1560	.2843	.3952	.6541	1.074	1.560	1.978	1.868	2.404	2.820
$\beta/\gamma$	.4190	.7687	1.064	1.626	2.580	3.817	4.861	5.114	6.390	7.317

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream S. F. Little Barren River Gage Location at Edmonton, Kentucky  
 USGS No. 03-3075.00 CTU No. 29 Drainage Area 18.1 Sq. Mi.  
 Period of Record 1942-59 Date 8/30/61 N = 18 Years

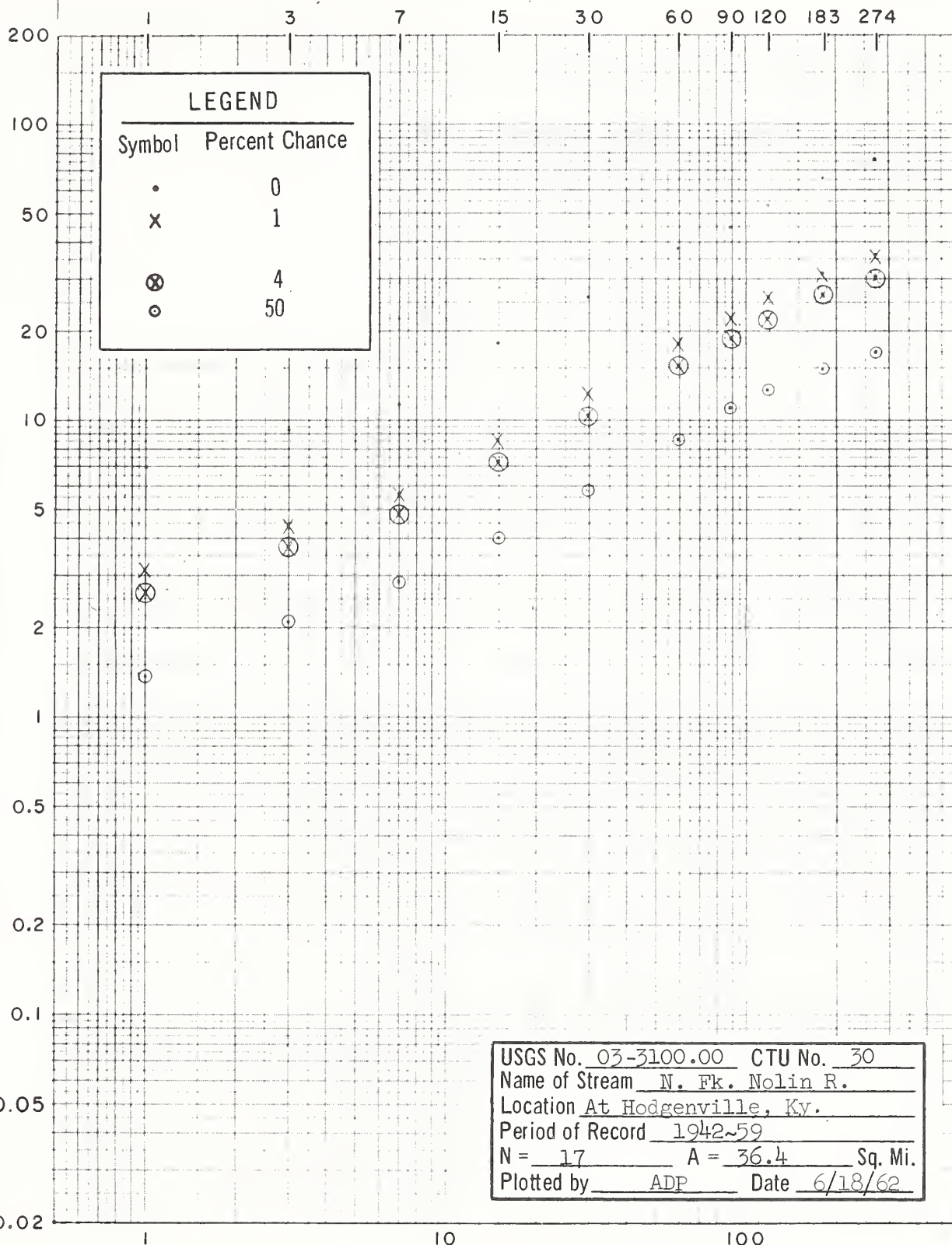
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.094	8.170	12.77	16.46	26.61	33.95	41.36	46.95	60.50	74.76
0.2	2.583	4.906	7.325	9.653	15.27	20.65	25.55	29.36	36.68	43.38
1	2.300	4.314	6.359	8.432	13.26	18.23	22.64	26.09	32.34	37.77
2	2.167	4.040	5.914	7.871	12.33	17.10	21.28	24.56	30.33	35.20
4	2.026	3.750	5.444	7.277	11.35	15.89	19.82	22.92	28.18	32.48
10	1.818	3.326	4.762	6.407	9.926	14.15	17.72	20.55	25.07	28.50
20	1.638	2.959	4.176	5.662	8.705	12.63	15.88	18.47	22.36	25.09
50	1.325	2.332	3.190	4.394	6.650	10.03	12.72	14.88	17.72	19.33
80	1.055	1.800	2.373	3.330	4.946	7.812	10.01	11.79	13.78	14.52
95	.835	1.377	1.738	2.496	3.622	6.036	7.816	9.278	10.62	10.76
99	.674	1.074	1.300	1.906	2.711	4.759	6.229	7.452	8.351	8.141
Y	14.99	11.88	9.293	10.46	9.127	12.55	13.60	14.42	12.36	9.798
E	.0904	.2026	.3578	.4351	.7528	.8192	.9584	1.057	1.471	2.041
EV	.3499	.6983	1.091	1.407	2.274	2.902	3.535	4.013	5.171	6.390

Remarks:

1952 appeared as a low outlier and was deleted from the 1 day duration.

RUNOFF VOLUME IN INCHES (DEPTH)



USGS No. 03-3100.00 CTU No. 30  
 Name of Stream N. Fk. Nolin R.  
 Location At Hodgenville, Ky.  
 Period of Record 1942-59  
 N = 17 A = 36.4 Sq. Mi.  
 Plotted by ADP Date 6/18/62

DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

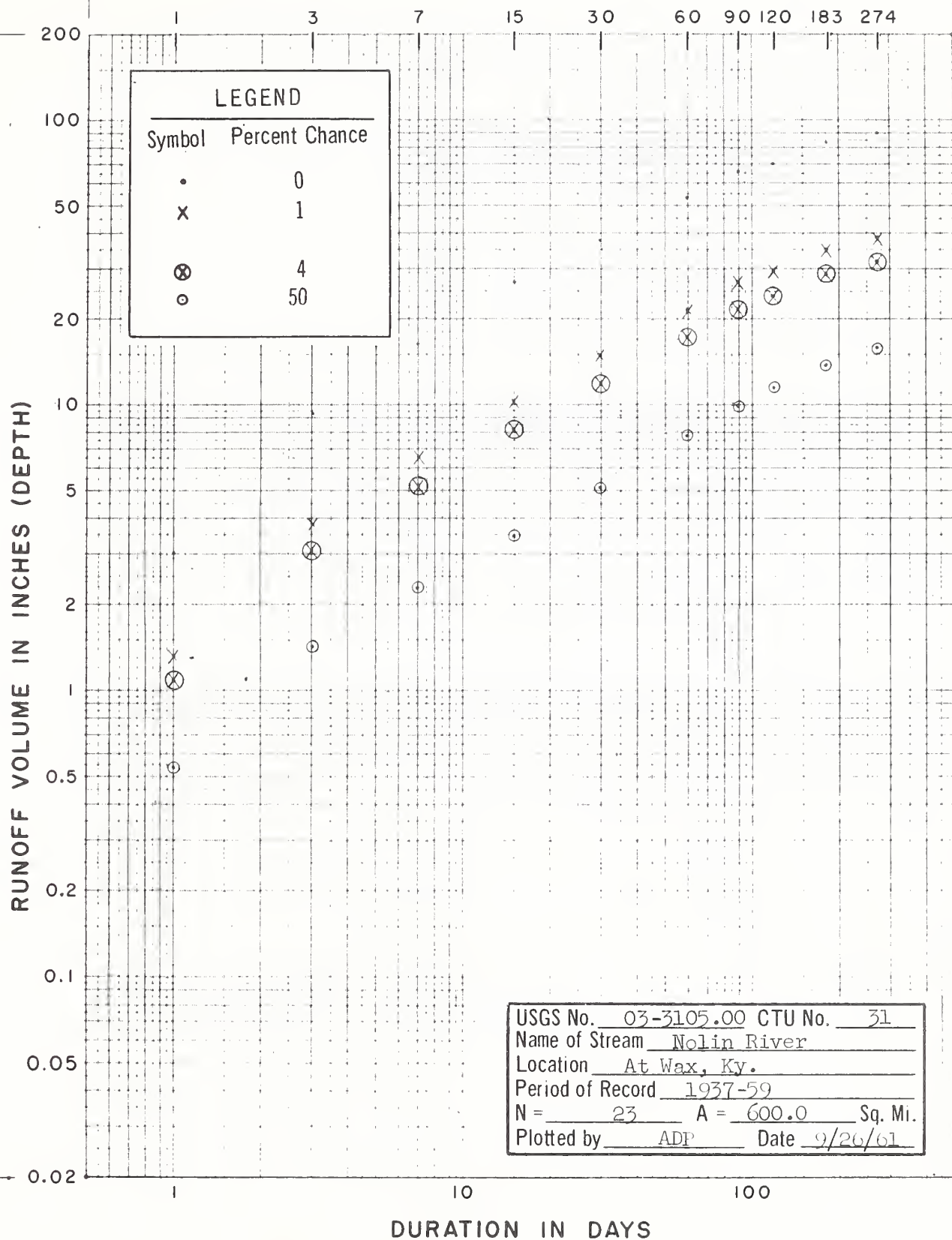
Name of Stream N. F. Nolin River Gage Location at Hodgenville, Kentucky  
 USGS No. 03-3100.00 CITU No. 30 Drainage Area 36.4 Sq. Mi.  
 Period of Record 1942-59 Date 9/6/61 N = 17 Years

		Runoff Volume in Inches (Depth)										Duration in Days	
% Probability (Greater than)		1	3	7	15	30	60	90	120	183	274		
0.0	6.928	9.304	11.37	18.36	26.16	38.34	45.14	53.68	66.26	76.88			
0.2	3.695	5.159	6.548	10.10	14.45	21.26	25.81	30.35	36.74	42.46			
1	3.135	4.438	5.690	8.664	12.41	18.29	22.38	26.23	31.60	36.47			
2	2.880	4.107	5.296	8.006	11.48	16.92	20.80	24.33	29.25	33.73			
4	2.611	3.757	4.879	7.310	10.49	15.48	19.13	22.32	26.76	30.83			
10	2.227	3.256	4.273	6.311	9.074	13.42	16.72	19.42	23.18	26.67			
20	1.904	2.824	3.752	5.457	7.859	11.64	14.64	16.93	20.11	23.10			
50	1.373	2.109	2.874	4.044	5.846	8.691	11.15	12.78	15.02	17.18			
80	.951	1.526	2.146	2.899	4.210	6.287	8.264	9.360	10.87	12.37			
95	.640	1.082	1.578	2.032	2.969	4.458	6.030	6.740	7.704	8.724			
99	.440	.785	1.185	1.458	2.142	3.236	4.495	4.960	5.593	6.293			
$\gamma$	6.294	7.862	9.321	7.386	7.650	7.866	8.928	8.354	7.866	7.632			
$\beta$	.2321	.2812	.3183	.5725	.8014	1.158	1.291	1.587	2.002	2.358			
$\beta/\gamma$	.5822	.7885	.9717	1.556	2.217	3.249	3.858	4.588	5.615	6.515			

Remarks:

1954 appeared as a low outlier and was deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

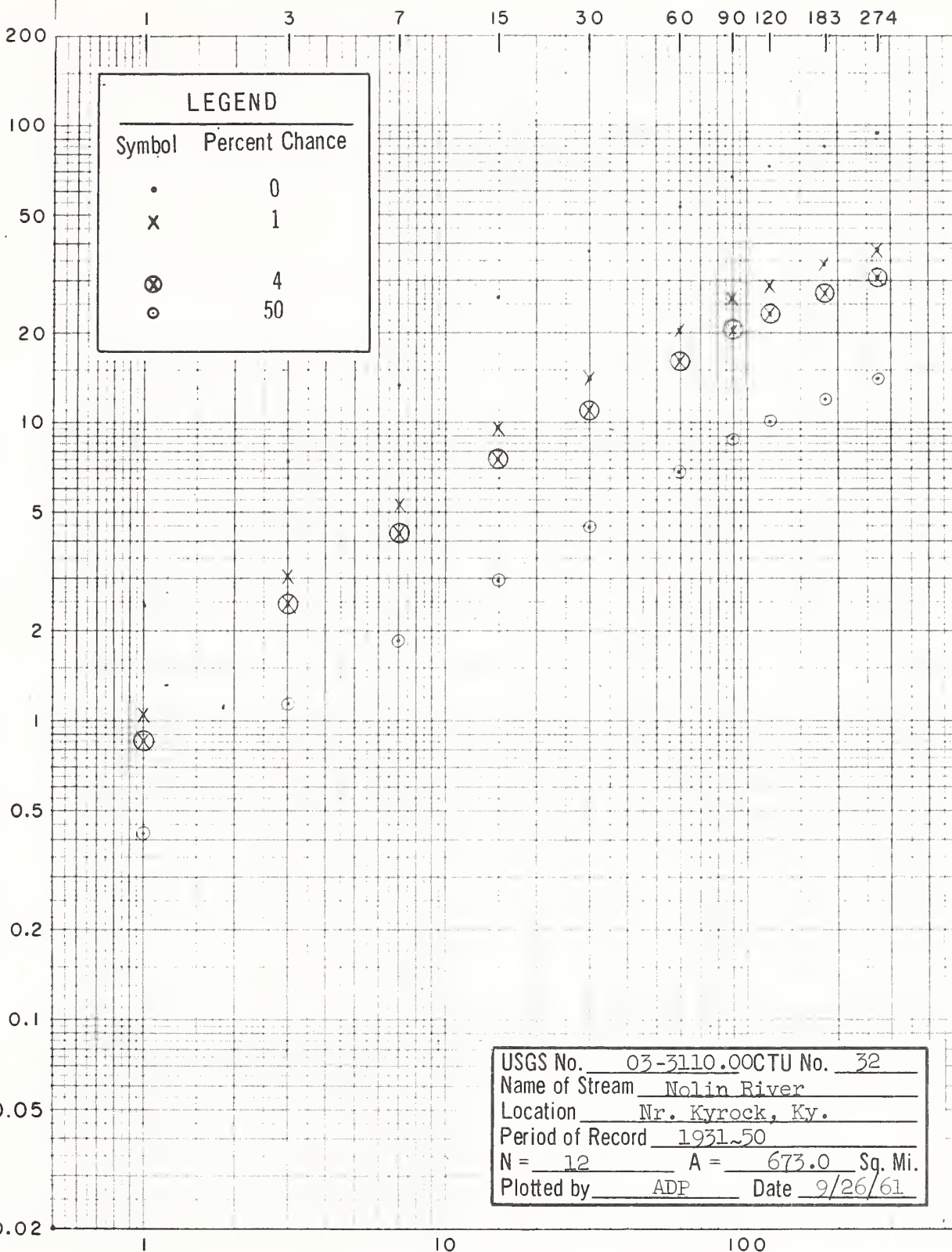
Name of Stream Nolin River Gage Location at Wax, Kentucky  
 USGS No. 03-3105.00 CITU No. 31 Drainage Area 600.0 Sq. Mi.  
 Period of Record 1937-59 Date 9-6-61 N = 23 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.010	9.272	16.37	26.84	37.76	53.61	66.32	70.60	83.67	90.12
0.2	1.552	4.603	7.981	12.72	18.24	26.26	32.60	35.60	42.27	46.36
1	1.304	3.811	6.541	10.36	14.92	21.64	26.95	29.65	35.25	38.91
2	1.191	3.455	5.892	9.304	13.43	19.56	24.40	26.96	32.08	35.53
4	1.074	3.082	5.219	8.205	11.88	17.39	21.75	24.15	28.76	31.99
10	.906	2.557	4.277	6.675	9.706	14.34	18.01	20.18	24.07	26.95
20	.765	2.118	3.494	5.411	7.912	11.80	14.89	16.85	20.13	22.73
50	.537	1.425	2.278	3.459	5.127	7.820	9.963	11.53	13.83	15.91
80	.360	.902	1.381	2.043	3.081	4.855	6.268	7.471	9.011	10.61
95	.233	.544	.789	1.128	1.743	2.858	3.754	4.641	5.630	6.830
99	.153	.330	.450	.619	.982	1.686	2.257	2.911	3.559	4.461
Y	5.326	4.153	3.644	3.295	3.536	3.909	4.124	4.557	4.709	5.209
B	.1078	.3700	.6913	1.164	1.607	2.187	2.633	2.711	3.161	3.263
B/V	.2488	.7538	1.320	2.113	3.021	4.323	5.348	5.787	6.858	7.448

Remarks:

RUNOFF VOLUME IN INCHES (DEPTH)



DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream Nolin River Gage Location near Kyrock, Kentucky  
 USGS No. 03-3110.00 CTU No. 32 Drainage Area 673.0 Sq. Mi.  
 Period of Record 1931, 1940-50 Date 9-7-61 N = 12 Years

Runoff Volume in Inches (Depth)

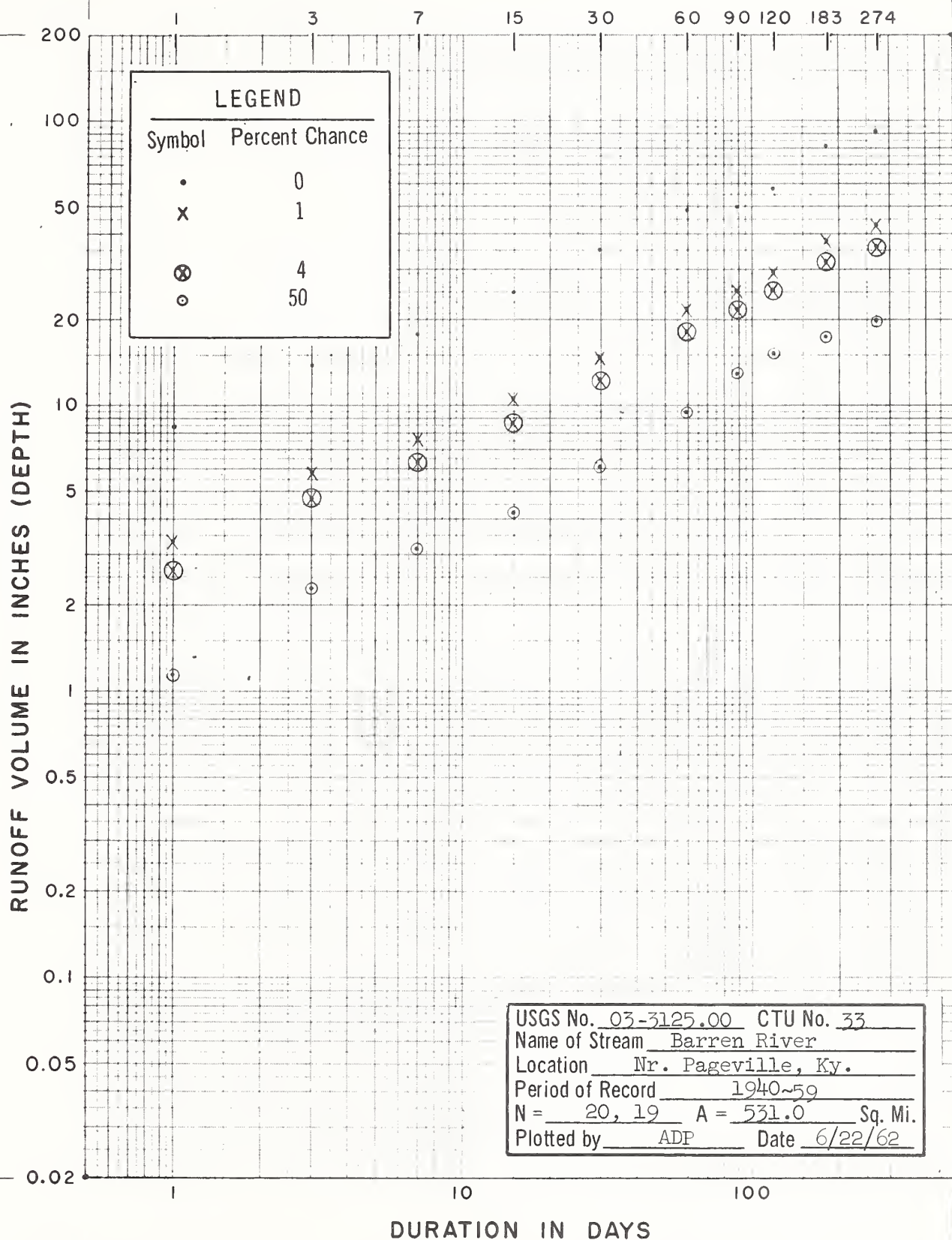
Duration in Days

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	2.425	7.385	13.43	26.38	37.88	53.21	67.22	73.18	85.52	94.57
0.2	1.242	3.673	6.548	12.06	17.49	25.25	32.16	35.68	41.76	46.49
1	1.040	3.045	5.366	9.712	14.15	20.57	26.26	29.24	34.29	38.43
2	.948	2.763	4.835	8.656	12.65	18.47	23.60	26.35	30.93	34.80
4	.853	2.468	4.282	7.573	11.10	16.29	20.84	23.34	27.43	31.02
10	.717	2.051	3.509	6.072	8.958	13.25	17.00	19.12	22.53	25.69
20	.602	1.703	2.867	4.850	7.200	10.74	13.82	15.62	18.45	21.23
50	.419	1.150	1.869	2.979	4.499	6.866	8.893	10.19	12.10	14.21
80	.277	.733	1.133	1.672	2.582	4.056	5.303	6.173	7.394	8.939
95	.176	.445	.648	.856	1.367	2.240	2.966	3.529	4.269	5.354
99	.114	.273	.369	.429	.711	1.229	1.649	2.013	2.462	3.219
$\gamma$	4.994	4.336	3.631	2.778	2.953	3.339	3.373	3.617	3.728	4.063
$\beta$	.0897	.2883	.5681	1.208	1.695	2.295	2.905	3.103	3.572	3.873
$\beta/\gamma$	.2004	.6004	1.083	2.014	2.914	4.194	5.335	5.902	6.897	7.627

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

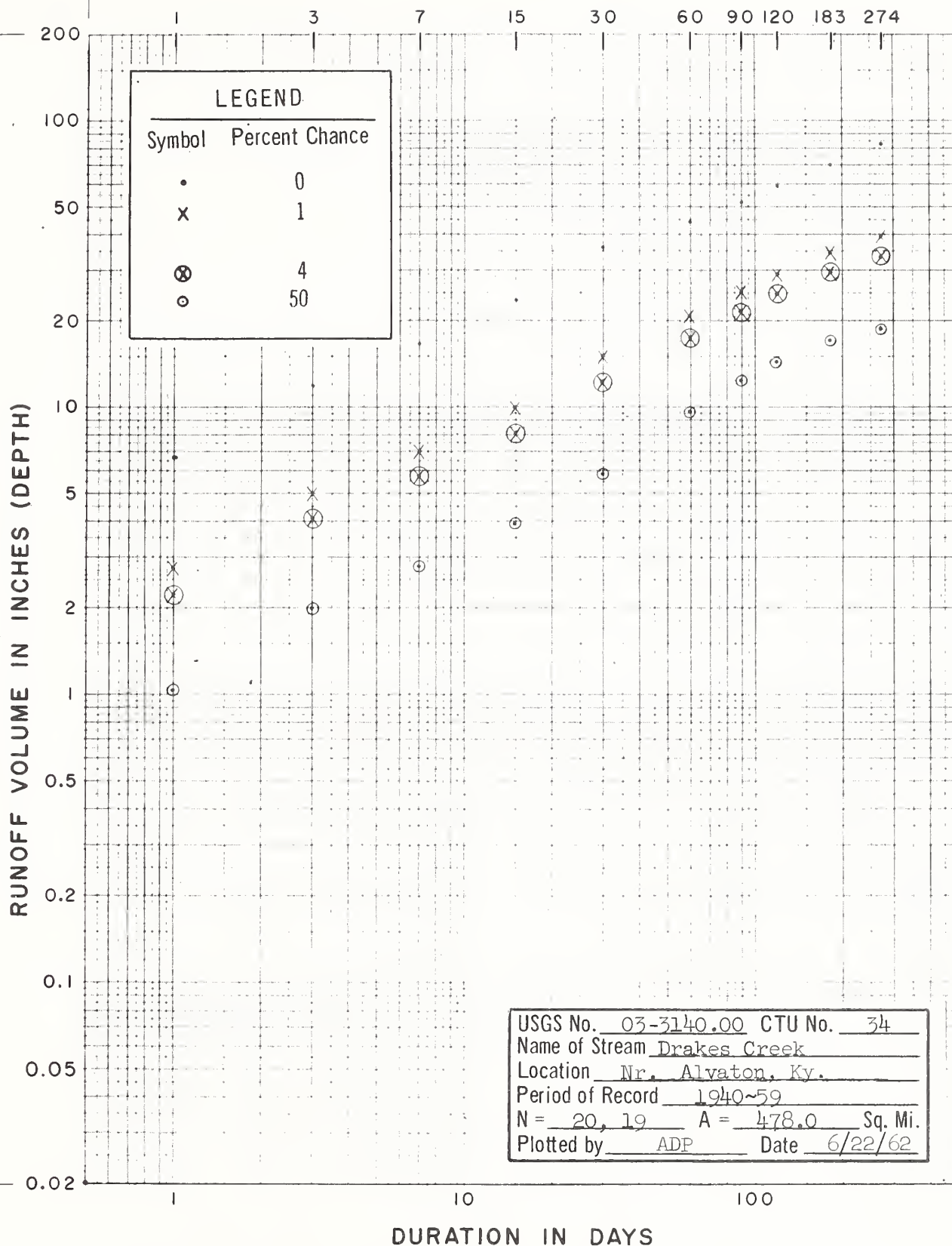
Name of Stream Barren River Gage Location near Pageville, Kentucky  
 USGS No. 03-3125.00 CITU No. 33 Drainage Area 531.0 Sq. Mi.  
 Period of Record 1940-59 Date 6-22-62 N = 20, 19 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	8.324	13.64	17.62	24.79	34.92	48.58	50.02	57.68	81.61	91.77
0.2	4.020	6.904	9.080	12.57	17.92	25.81	29.02	33.70	44.57	50.32
1	3.288	5.766	7.629	10.51	14.74	21.85	25.27	29.41	38.09	43.07
2	2.959	5.250	6.971	9.581	13.71	20.05	23.55	27.44	35.13	39.76
4	2.618	4.712	6.283	8.606	12.34	18.16	21.73	25.35	32.01	36.27
10	2.140	3.949	5.300	7.222	10.38	15.45	19.07	22.30	27.54	31.26
20	1.744	3.308	4.476	6.061	8.742	13.18	16.79	19.68	23.73	26.98
50	1.130	2.282	3.144	4.196	6.095	9.450	12.93	15.24	17.44	19.91
80	.679	1.495	2.105	2.761	4.049	6.507	9.714	11.52	12.37	14.20
95	.384	.940	1.363	1.748	2.592	4.343	7.200	8.598	8.569	9.892
99	.216	.598	.895	1.120	1.683	2.955	5.447	6.547	6.065	7.054
γ	3.547	4.763	5.266	4.895	5.114	5.968	9.771	10.11	7.049	7.159
β	.3536	.5122	.6343	.9178	1.276	1.671	1.368	1.550	2.605	2.907
β/γ	.6659	1.118	1.456	2.032	2.886	4.082	4.275	4.930	6.916	7.777

Remarks:

1941 appeared as a low outlier and was deleted from the 90 and 120 day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

Name of Stream Drakes Creek Gauge Location near Alvaton, Kentucky  
 USGS No. 03-3140.00 CTU No. 34 Drainage Area 478.0 Sq. Mi.  
 Period of Record 1940-59 Date 6/22/62 N = 20, 19 Years

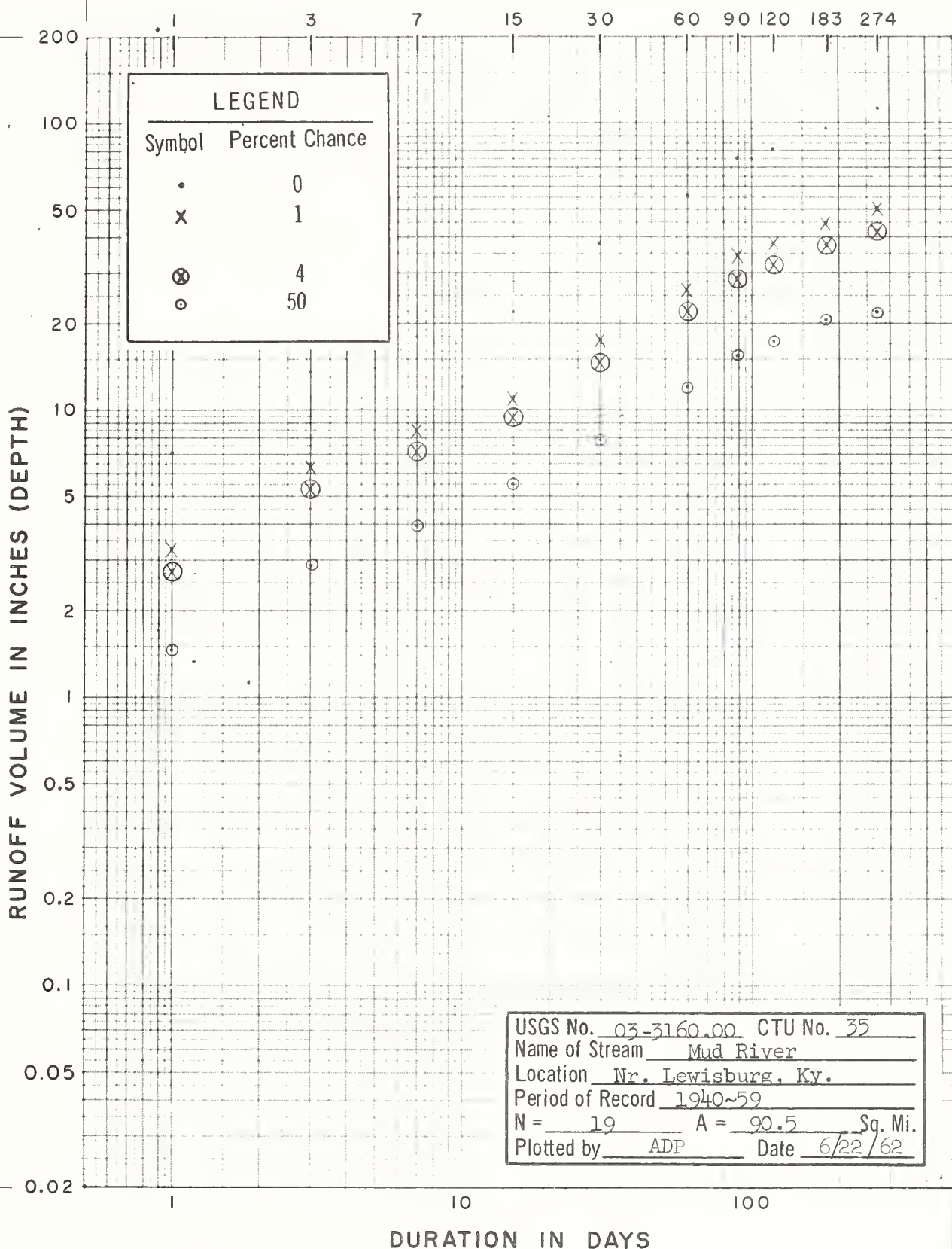
Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.582	11.77	16.51	23.49	35.87	43.98	51.66	59.20	70.50	83.24
0.2	3.274	5.967	8.371	11.89	18.08	24.20	29.32	33.73	40.17	46.16
1	2.715	4.989	7.000	9.927	15.06	20.75	25.37	29.21	34.79	39.70
2	2.463	4.548	6.379	9.040	13.70	19.18	23.54	27.13	32.31	36.75
4	2.200	4.085	5.730	8.114	12.27	17.51	21.62	24.93	29.69	33.61
10	1.828	3.428	4.809	6.799	10.25	15.12	18.84	21.76	25.91	29.13
20	1.518	2.877	4.036	5.696	8.558	13.07	16.45	19.03	22.66	25.27
50	1.025	1.992	2.794	3.939	5.856	9.686	12.46	14.45	17.21	18.87
80	.653	1.311	1.839	2.574	3.796	6.943	9.162	10.67	12.70	13.65
95	.397	.829	1.164	1.619	2.358	4.867	6.628	7.752	9.232	9.679
99	.244	.531	.746	1.030	1.479	3.492	4.901	5.753	6.852	7.026
γ	4.323	4.905	4.940	4.844	4.594	7.458	8.577	8.705	8.703	7.765
β	.2574	.4355	.6086	.8745	1.372	1.365	1.508	1.715	2.043	2.532
β/γ	.5352	.9645	1.353	1.925	2.940	3.727	4.416	5.060	6.026	7.054

Remarks:

1941 appeared as a low outlier and was deleted from the 60-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Mud River Gage Location near Lewisburg, Kentucky  
 USGS No. 03-3160.00 CTTU No. 35 Drainage Area 90.5 Sq. Mi.  
 Period of Record 1940-59 Date 6/22/62 N = 19 Years

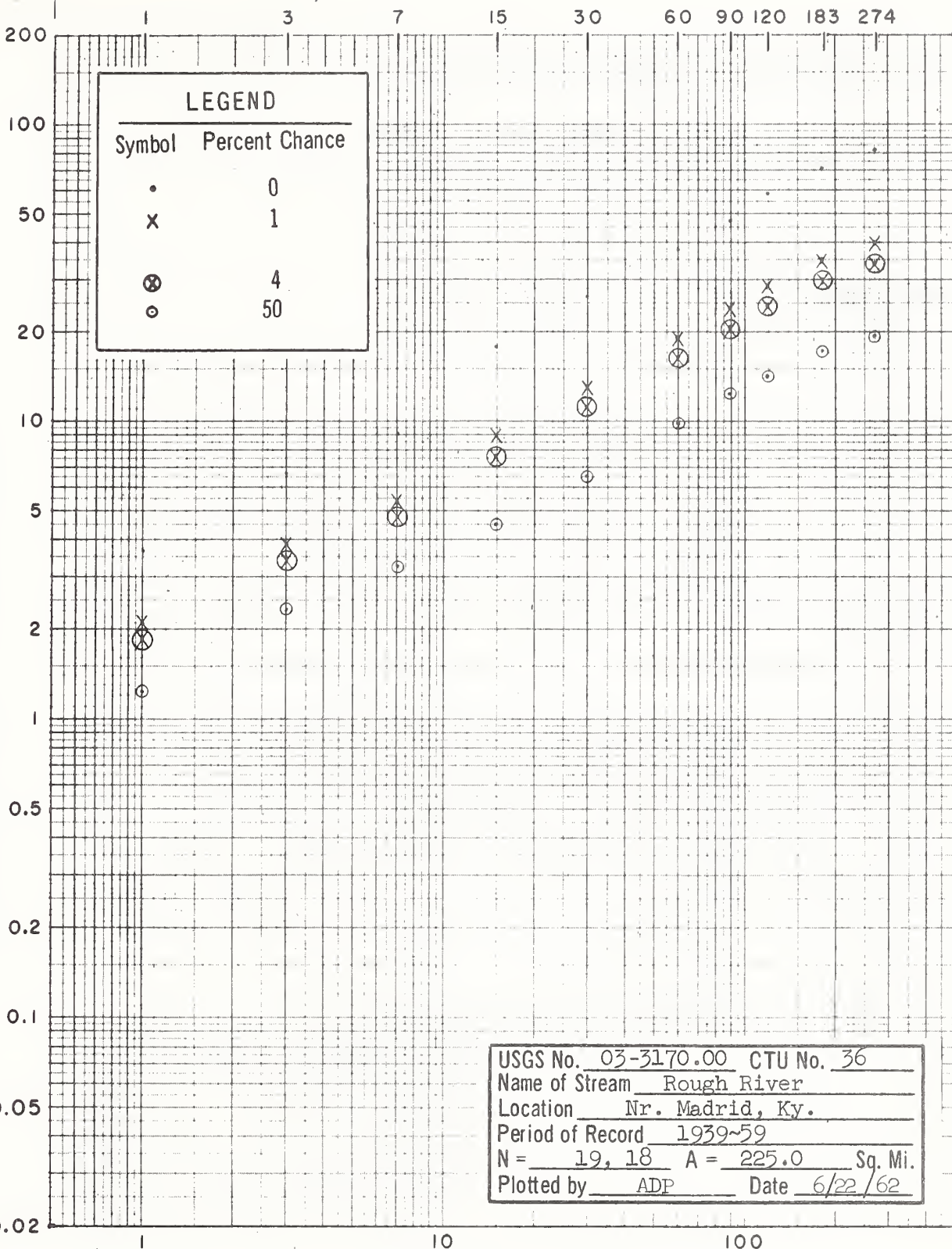
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	7.086	13.51	18.01	21.96	38.38	56.47	75.81	81.97	96.89	113.54
0.2	3.809	7.380	9.910	12.65	20.63	30.85	40.75	44.77	52.92	60.32
1	3.244	6.307	8.497	10.99	17.57	26.36	34.70	38.26	45.23	51.07
2	2.986	5.817	7.851	10.23	16.17	24.31	31.94	35.29	41.71	46.86
4	2.714	5.300	7.169	9.424	14.70	22.15	29.04	32.16	38.01	42.44
10	2.325	4.559	6.189	8.253	12.59	19.06	24.88	27.66	32.70	36.12
20	1.996	3.928	5.352	7.247	10.81	16.42	21.36	23.84	28.17	30.80
50	1.454	2.887	3.966	5.552	7.872	12.07	15.55	17.51	20.70	22.09
80	1.020	2.048	2.843	4.144	5.524	8.562	10.91	12.43	14.69	15.21
95	.697	1.419	1.993	3.048	3.773	5.930	7.454	8.607	10.17	10.15
99	.487	1.004	1.430	2.290	2.635	4.197	5.205	6.093	7.201	6.908
$\gamma$	6.644	6.988	7.493	9.373	6.605	6.914	6.506	7.043	6.917	5.997
$\beta$	.2310	.4331	.5575	.6130	1.255	1.820	2.498	2.618	3.122	3.896
$\beta/\gamma$	.5955	1.145	1.526	1.877	3.225	4.786	6.371	6.947	8.211	9.541

**Remarks:**

1941 appeared as a low outlier and was deleted from all durations.

RUNOFF VOLUME IN INCHES (DEPTH)



USGS No. 03-3170.00 CTU No. 36  
 Name of Stream Rough River  
 Location Nr. Madrid, Ky.  
 Period of Record 1939~59  
 N = 19, 18 A = 225.0 Sq. Mi.  
 Plotted by ADP Date 6/22/62

DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Rough River Gage Location near Madrid, Kentucky  
 USGS No. 03-3170.00 CTU No. 36 Drainage Area 225.0 Sq. Mi.  
 Period of Record 1939-59 Date 6/22/62 N = 19,18 Years

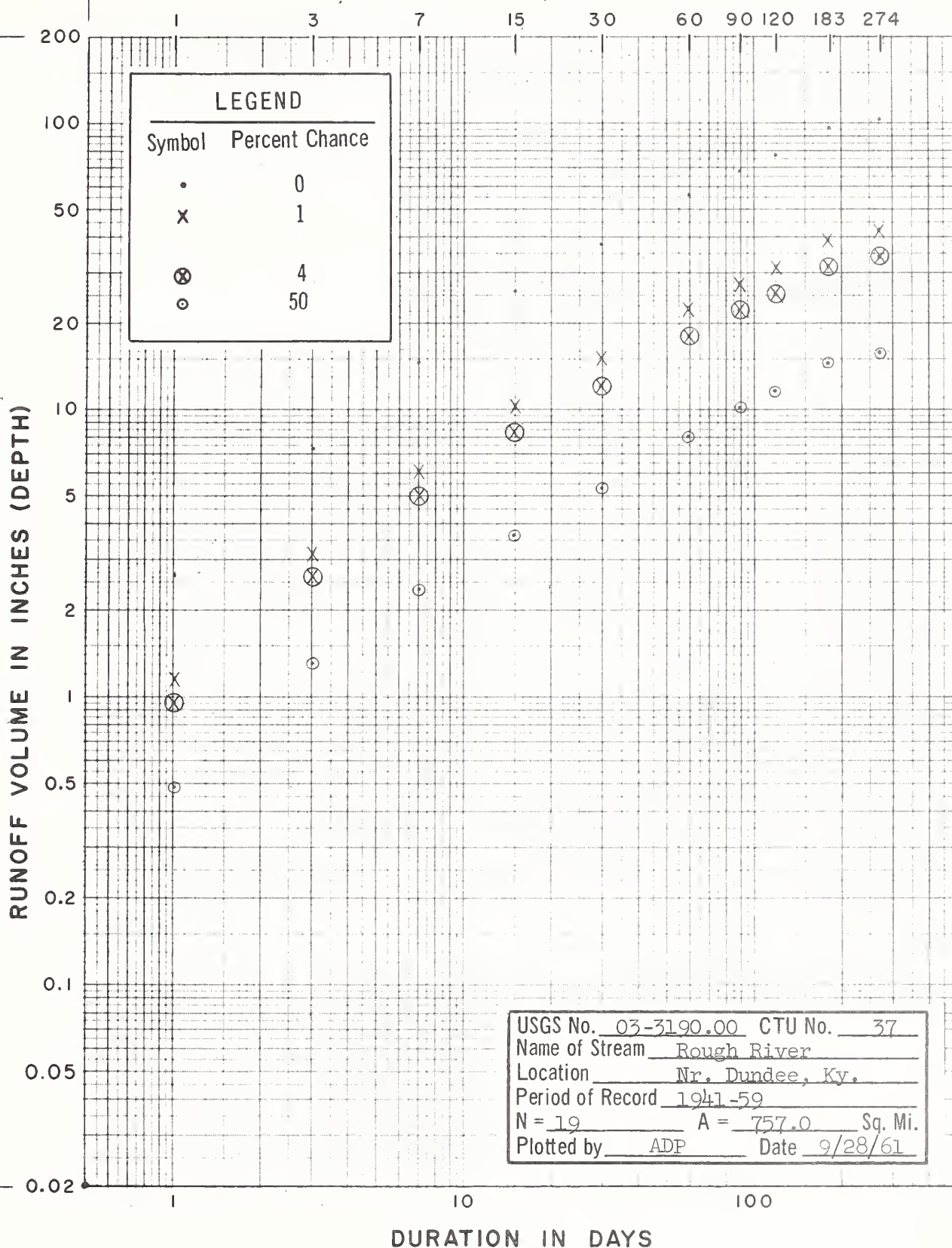
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.636	6.668	9.049	17.83	26.23	37.72	47.11	58.21	70.98	81.82
0.2	2.327	4.312	5.910	10.27	15.05	21.96	27.53	33.16	40.44	46.27
1	2.081	3.871	5.324	8.922	13.07	19.15	24.02	28.72	35.03	39.98
2	1.966	3.665	5.049	8.303	12.15	17.85	22.41	26.67	32.53	37.08
4	1.846	3.448	4.757	7.650	11.19	16.49	20.71	24.51	29.89	34.02
10	1.663	3.118	4.317	6.699	9.785	14.48	18.21	21.39	26.09	29.60
20	1.505	2.832	3.934	5.883	8.582	12.77	16.07	18.71	22.81	25.81
50	1.230	2.334	3.264	4.507	6.555	9.860	12.45	14.21	17.33	19.48
80	.992	1.898	2.675	3.364	4.876	7.429	9.406	10.49	12.79	14.27
95	.795	1.536	2.184	2.474	3.571	5.526	7.023	7.621	9.295	10.27
99	.650	1.267	1.819	1.859	2.672	4.195	5.347	5.656	6.898	7.560
Y	16.55	18.09	19.30	9.407	9.110	9.965	10.27	8.729	8.876	8.320
B	.0757	.1317	.1716	.4968	.7427	1.021	1.256	1.684	2.036	2.425
B/Y	.3081	.5603	.7541	1.524	2.242	3.224	4.027	4.975	6.067	6.994

**Remarks:**

1941 and 1954 appeared as low outliers and were deleted from all durations.  
 1944 appeared as a low outlier and was deleted from the 1, 3, and 7-day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

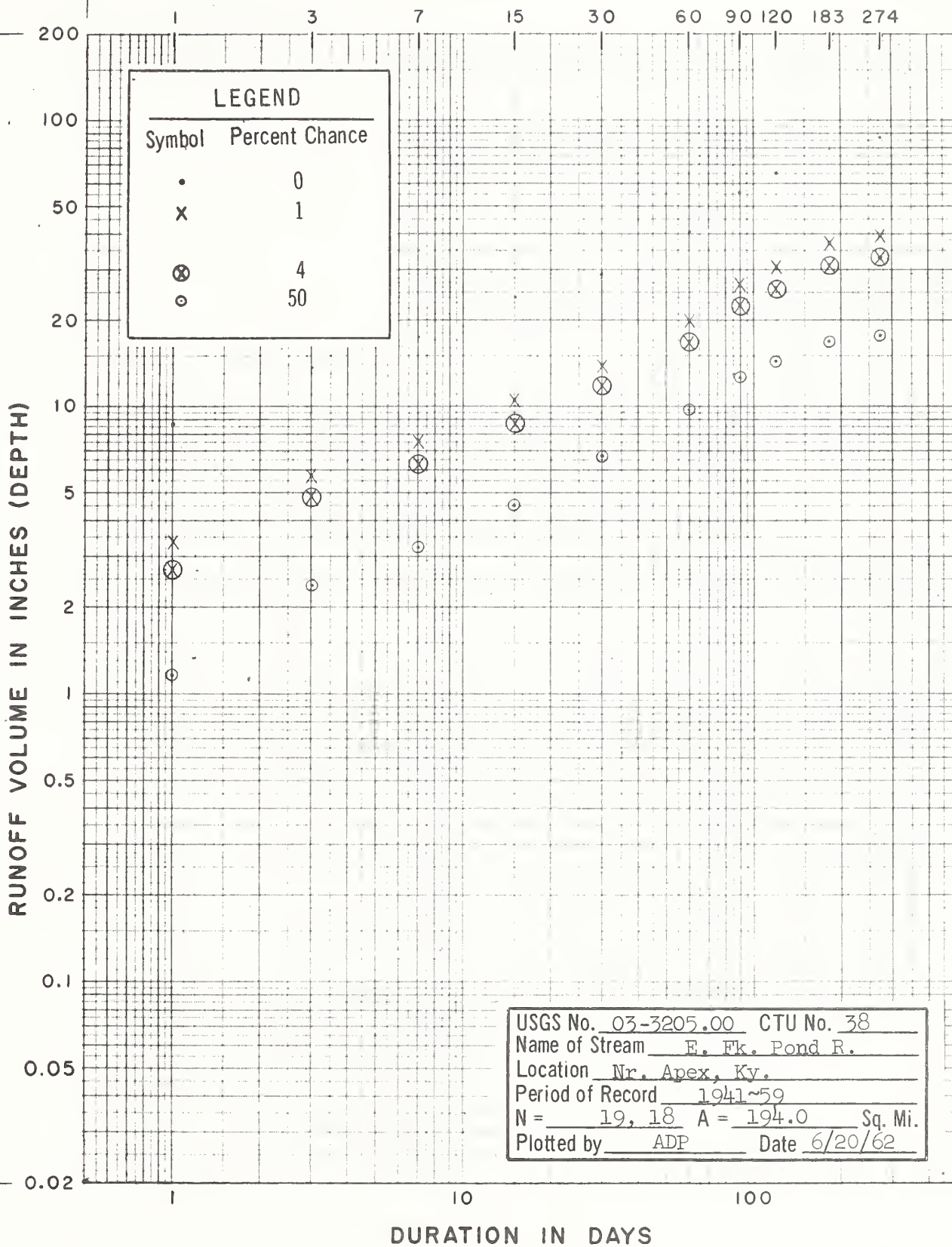
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Rough River Gauge Location near Dundee, Kentucky  
 USGS No. 03-3190.00 CTU No. 37 Drainage Area 757.0 Sq. Mi.  
 Period of Record 1941-59 Date 9-7-61 N = 19 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	2.612	7.242	14.46	25.71	37.53	55.97	67.60	77.45	96.35	103.0
0.2	1.354	3.739	7.289	12.55	18.33	27.37	33.23	38.07	47.36	51.14
1	1.142	3.146	6.071	10.31	15.05	22.52	27.47	31.47	39.15	42.35
2	1.045	2.876	5.521	9.295	13.57	20.33	24.88	28.50	35.45	38.39
4	.944	2.594	4.946	8.244	12.04	18.06	22.17	25.40	31.60	34.25
10	.799	2.191	4.132	6.770	9.886	14.86	18.36	21.04	26.17	28.41
20	.678	1.854	3.450	5.545	8.097	12.20	15.18	17.39	21.63	23.54
50	.481	1.306	2.361	3.636	5.309	8.044	10.16	11.64	14.48	15.83
80	.326	.879	1.530	2.222	3.245	4.956	6.390	7.320	9.106	10.03
95	.214	.571	.950	1.283	1.874	2.889	3.827	4.385	5.455	6.047
99	.143	.378	.596	.740	1.081	1.688	2.301	2.636	3.279	3.669
$\gamma$	5.579	5.420	4.574	3.734	3.706	3.795	4.069	4.144	4.055	4.170
$\beta$	.0914	.2571	.5541	1.073	1.572	2.317	2.703	3.068	3.859	4.101
$\beta/\gamma$	.2159	.5985	1.185	2.073	3.027	4.514	5.452	6.246	7.770	8.376

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

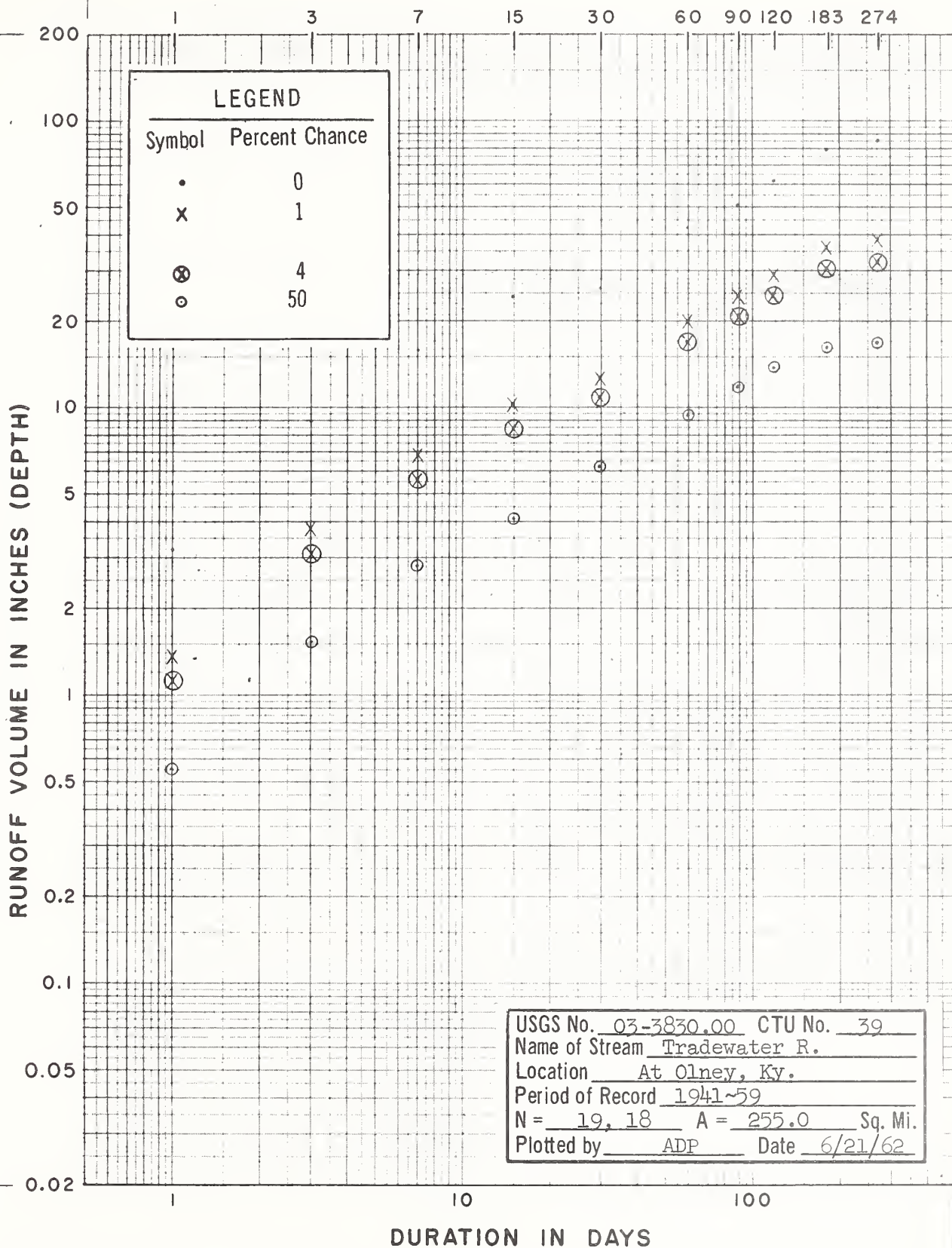
Name of Stream E. F. Pond River Gauge Location near Apex, Kentucky  
 USGS No. 03-3205.00 CTU No. 38 Drainage Area 194.0 Sq. Mi.  
 Period of Record 1941-59 Date 9/7/61 N = 19,18 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	8.563	13.67	17.47	24.05	28.91	40.77	56.25	65.34	80.23	87.43
0.2	4.135	7.018	9.076	12.54	16.29	23.14	31.19	36.09	43.82	46.99
1	3.383	5.771	7.660	10.61	14.05	20.02	26.83	31.00	37.45	40.02
2	3.044	5.370	7.015	9.729	13.02	18.58	24.83	28.67	34.54	36.84
4	2.693	4.831	6.341	8.805	11.94	17.06	22.71	26.20	31.47	33.49
10	2.201	4.066	5.377	7.487	10.38	14.87	19.68	22.66	27.07	28.69
20	1.794	3.423	4.567	6.374	9.032	12.98	17.08	19.63	23.33	24.63
50	1.162	2.387	3.248	4.558	6.793	9.831	12.75	14.60	17.14	17.93
80	.699	1.585	2.211	3.127	4.954	7.231	9.224	10.51	12.16	12.59
95	.395	1.015	1.458	2.079	3.551	5.231	6.540	7.414	8.424	8.596
99	.223	.659	.979	1.408	2.602	3.868	4.748	5.349	5.963	6.002
$\gamma$	3.470	5.066	5.693	5.943	8.261	8.631	7.701	7.598	6.933	6.681
$\beta$	.3677	.5023	.6053	.8153	.8597	1.186	1.718	2.009	2.582	2.843
$\beta/\gamma$	.6850	1.130	1.444	1.988	2.471	3.485	4.767	5.537	6.799	7.347

Remarks: 1941 appeared as a low outlier and was deleted from the 30-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Tradewater River Gage Location at Olney, Kentucky  
 USGS No. 03-3830.00 CTU No. 39 Drainage Area 255.0 Sq. Mi.  
 Period of Record 1941-59 Date 6-21-62 N = 19.18 Years

**Runoff Volume in Inches (Depth)**

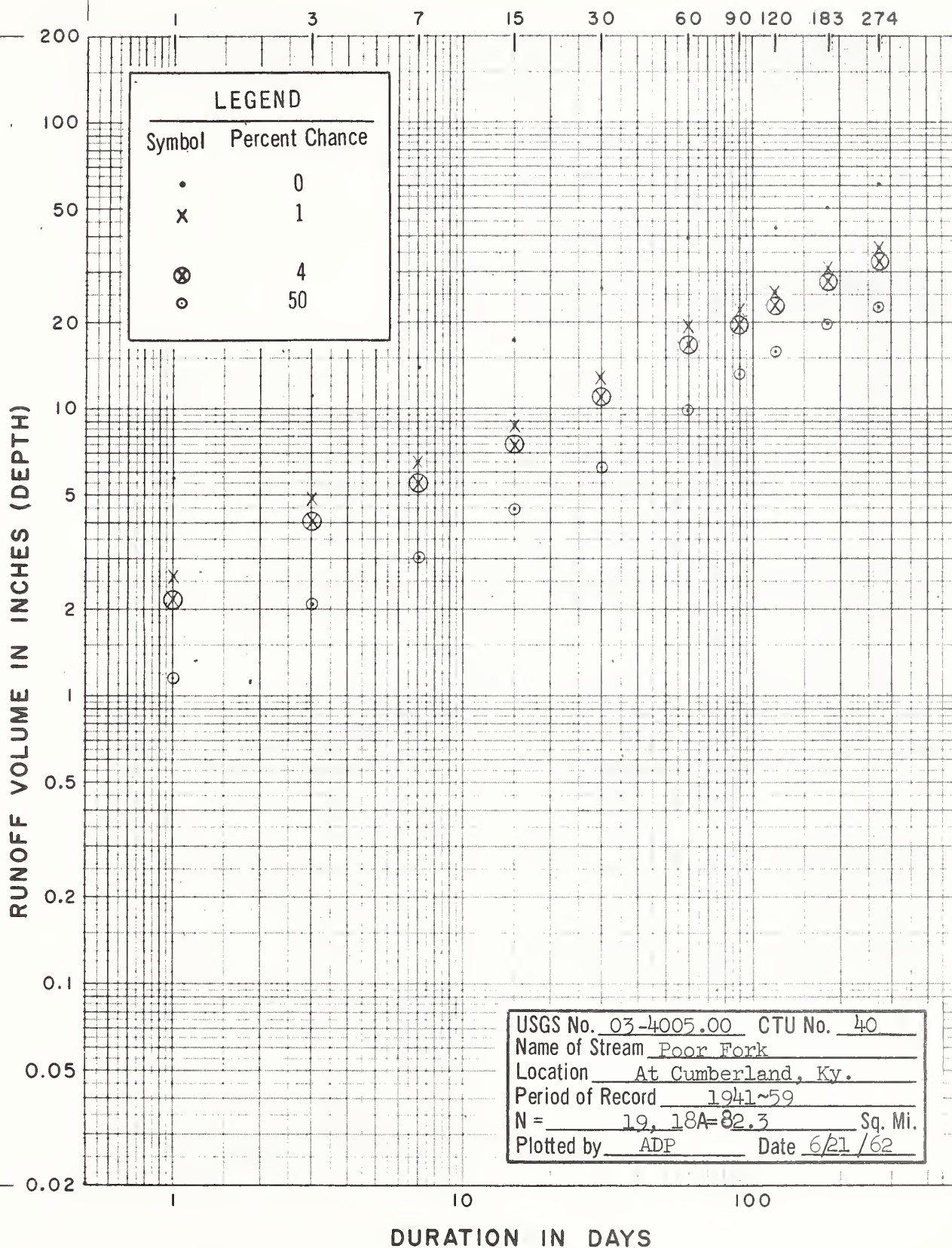
**Duration in Days**

% Probability  
(Greater than)

	1	3	7	15	30	60	90	120	183	274
0.0	3.185	8.880	15.75	24.17	25.80	41.95	50.23	61.62	78.84	84.73
0.2	1.632	4.549	8.119	12.26	14.65	23.17	28.30	34.04	42.38	45.19
1	1.366	3.809	6.822	10.25	12.67	19.90	24.41	29.23	36.09	38.34
2	1.246	3.474	6.234	9.340	11.76	18.40	22.63	27.03	33.22	35.22
4	1.120	3.123	5.618	8.390	10.80	16.82	20.74	24.71	30.20	31.94
10	.941	2.624	4.739	7.040	9.410	14.55	18.03	21.37	25.87	27.24
20	.791	2.206	4.002	5.909	8.215	12.60	15.69	18.51	22.21	23.28
50	.550	1.533	2.811	4.091	6.221	9.374	11.80	13.77	16.17	16.79
80	.363	1.014	1.883	2.692	4.576	6.750	8.607	9.916	11.68	11.63
95	.231	.645	1.219	1.704	3.310	4.760	6.169	6.992	7.752	7.832
99	.149	.416	.801	1.092	2.448	3.434	4.520	5.044	5.413	5.376
γ	4.960	5.019	5.323	4.853	8.536	7.682	8.248	7.593	6.548	6.277
β	.1182	.3276	.5642	.8992	.7548	1.283	1.495	1.895	2.589	2.842
β/γ	.2632	.7339	1.302	1.981	2.205	3.555	4.293	5.222	6.626	7.120

Remarks:

1941 appeared as a low outlier and was deleted from the 30-274 day durations.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

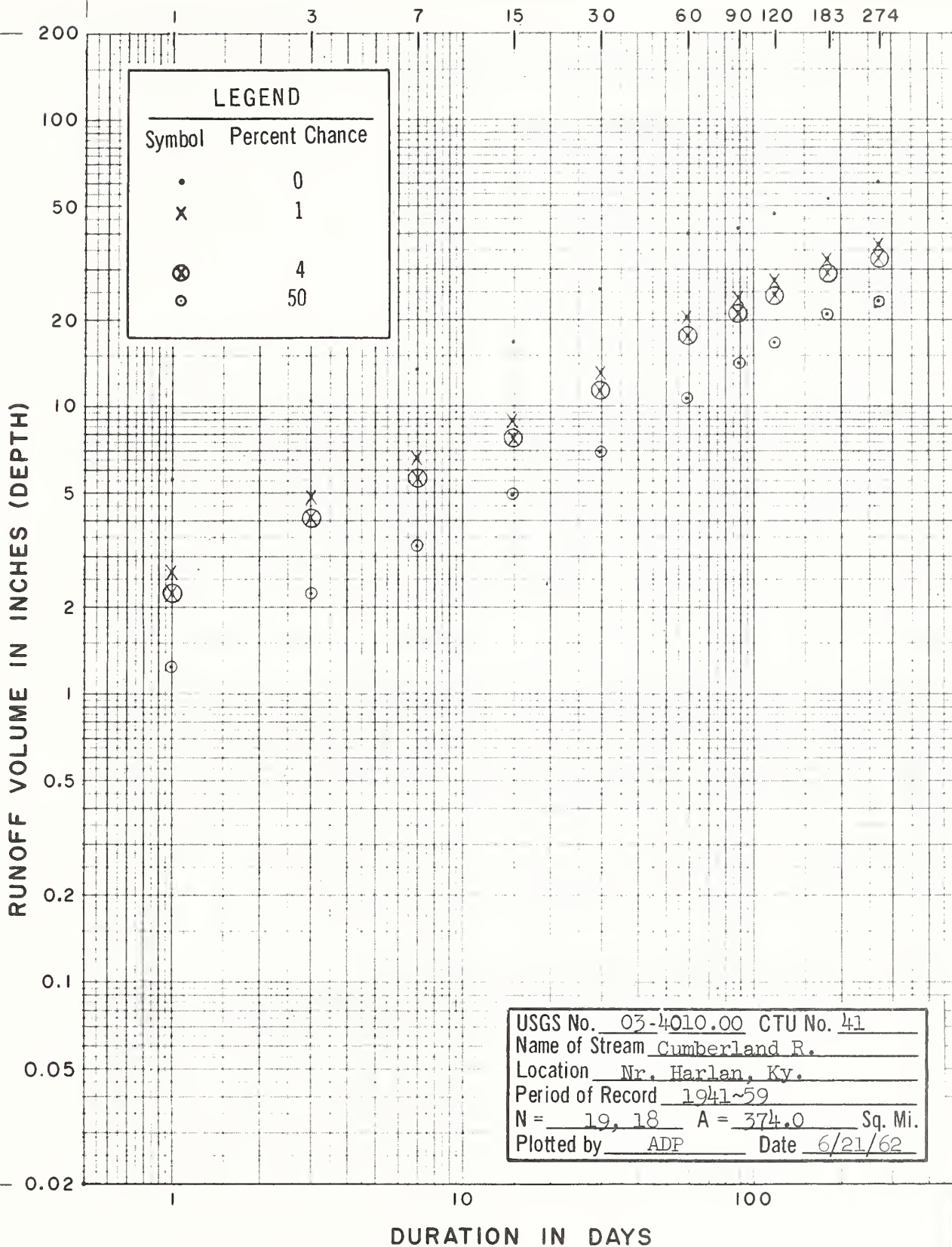
Name of Stream Poor Fork Gage Location at Cumberland, Kentucky  
 USGS No. 03-4005-00 CTU No. 40 Drainage Area 82.3 Sq. Mi.  
 Period of Record 1941-59 Date 6/21/62 N = 19,18 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.630	10.99	13.77	17.30	26.16	39.16	39.15	42.79	50.56	61.03
0.2	3.014	5.720	7.578	10.00	14.79	22.47	24.99	28.23	34.15	40.36
1	2.562	4.833	6.498	8.702	12.78	19.51	22.34	25.48	31.01	36.44
2	2.356	4.429	6.004	8.103	11.86	18.14	21.09	24.18	29.54	34.59
4	2.139	4.006	5.483	7.472	10.88	16.70	19.80	22.80	27.94	32.63
10	1.829	3.402	4.733	6.550	9.465	14.61	17.83	20.73	25.59	29.68
20	1.567	2.893	4.093	5.759	8.251	12.81	16.13	18.92	23.51	27.10
50	1.135	2.063	3.033	4.424	6.227	9.787	13.16	15.77	19.85	22.60
80	.792	1.410	2.174	3.313	4.561	7.280	10.59	12.98	16.58	18.62
95	.537	.934	1.524	2.446	3.285	5.332	8.477	10.63	13.83	15.28
99	.372	.629	1.093	1.844	2.417	3.990	6.921	8.901	11.75	12.80
γ	6.399	5.820	7.446	9.635	8.414	9.157	16.49	20.18	23.68	20.36
β	.1870	.3765	.4276	.4765	.7710	1.106	.8170	7.938	.8516	1.127
β/γ	.4731	.9083	1.167	1.479	2.236	3.347	3.318	3.566	4.144	5.086

Remarks: 1941 appeared as a low outlier and was deleted from the 90-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

VOLUME-DURATION-PROBABILITY ANALYSIS  
(Two-Parameter Gamma Distribution)

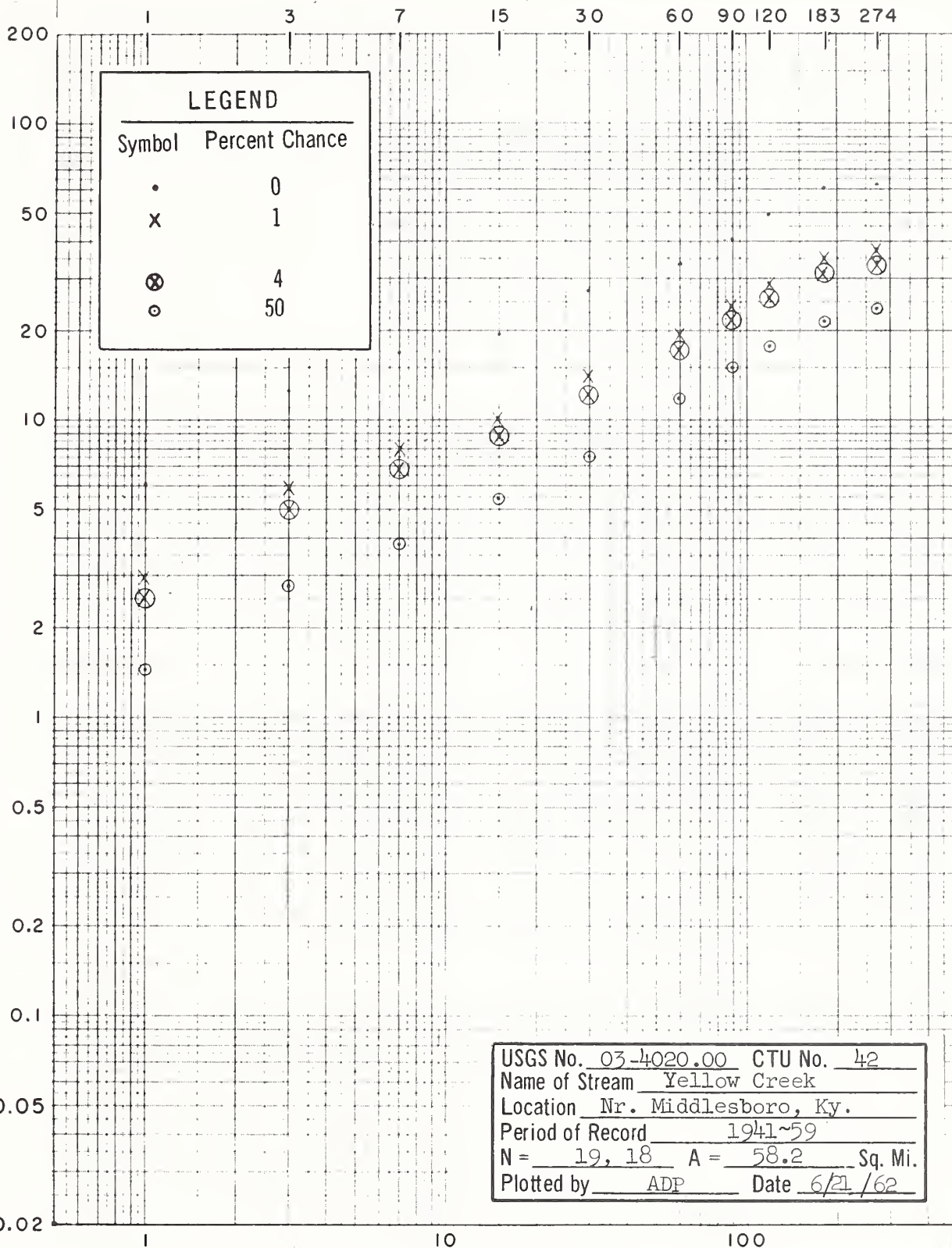
Name of Stream Cumberland River Gage Location near Harlan, Kentucky Drainage Area 374.0 Sq. Mi.  
 USGS No. 03-4010.00 CITU No. 41 Date 6-21-62 N = 19,18 Years  
 Period of Record 1941-59

Runoff Volume in Inches (Depth)

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.533	10.43	13.38	16.65	25.51	39.93	41.91	47.22	53.00	60.88
0.2	3.056	5.699	7.626	10.13	15.06	23.42	26.82	30.70	35.95	40.56
1	2.625	4.870	6.604	8.938	13.18	20.45	23.99	27.59	32.67	36.76
2	2.427	4.492	6.134	8.384	12.32	19.09	22.66	26.13	31.13	34.97
4	2.219	4.093	5.636	7.792	11.40	17.65	21.27	24.60	29.46	33.04
10	1.919	3.521	4.919	6.940	10.06	15.54	19.17	22.27	27.00	30.20
20	1.662	3.034	4.301	6.193	8.910	13.73	17.35	20.25	24.83	27.68
50	1.236	2.229	3.267	4.918	6.948	10.66	14.18	16.71	20.99	23.27
80	.890	1.582	2.412	3.831	5.295	8.079	11.43	13.63	17.56	19.35
95	.628	1.096	1.753	2.960	3.994	6.055	9.159	11.06	14.67	16.04
99	.453	.775	1.301	2.334	3.069	4.625	7.487	9.151	12.48	13.56
Y	7.584	6.937	8.805	12.56	10.80	10.36	16.50	18.43	23.94	22.32
B	.1702	.3357	.3854	.4016	.6634	1.060	.8742	.9242	.8881	1.056
B/Y	.4689	.8842	1.144	1.423	2.180	3.413	3.552	3.968	4.344	4.990

Remarks: 1941 appeared as a low outlier and was deleted from the 90-274 day durations.

RUNOFF VOLUME IN INCHES (DEPTH)



DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Yellow Creek Gage Location near Middlesboro, Kentucky  
 USGS No. 03-4020.00 CTU No. 42 Drainage Area 58.2 Sq. Mi.  
 Period of Record 1941-59 Date 6/21/62 N = 19.18 Years

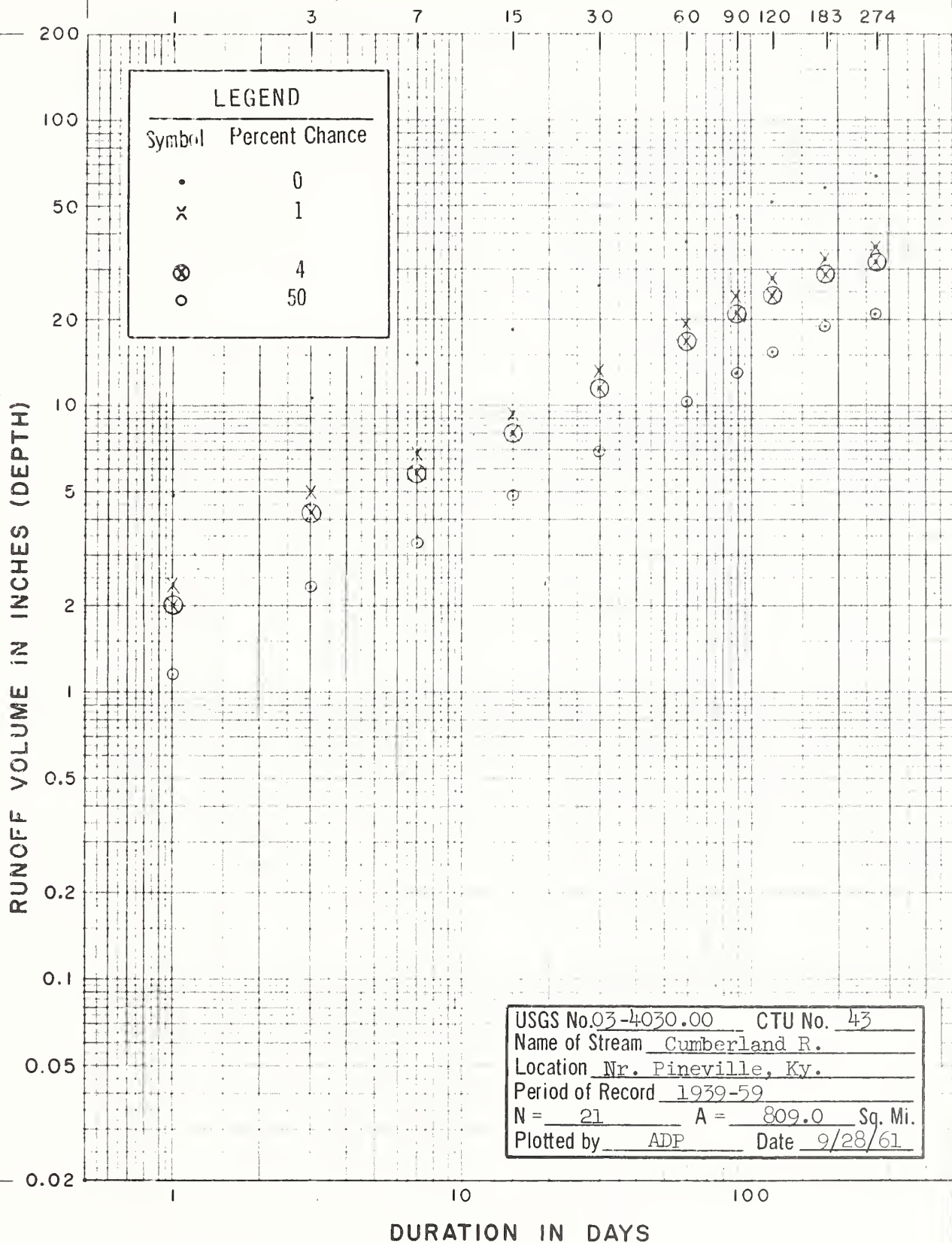
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.096	12.66	17.00	19.59	27.44	33.76	41.00	49.60	61.05	62.96
0.2	3.447	6.968	9.428	11.68	16.31	21.88	27.12	32.39	39.69	41.99
1	2.978	5.974	8.110	10.25	14.30	19.68	24.48	29.18	35.66	38.02
2	2.762	5.521	7.506	9.595	13.38	18.65	23.24	27.67	33.79	36.15
4	2.534	5.041	6.866	8.897	12.40	17.56	21.92	26.08	31.80	34.13
10	2.205	4.352	5.950	7.876	10.96	15.91	19.94	23.66	28.78	31.16
20	1.922	3.763	5.162	6.996	9.729	14.48	18.21	21.56	26.17	28.53
50	1.451	2.789	3.855	5.491	7.619	11.98	15.19	17.89	21.61	23.93
80	1.063	1.999	2.788	4.217	5.839	9.789	12.51	14.66	17.62	19.84
95	.765	1.401	1.977	3.207	4.427	7.961	10.26	11.97	14.29	16.40
99	.563	1.005	1.435	2.488	3.424	6.608	8.601	9.969	11.83	13.83
Y	8.375	7.387	7.764	11.39	11.17	18.83	20.32	19.43	18.42	21.85
B	.1800	.3949	.5173	.4959	.7017	.6482	.7579	.9376	1.195	1.113
B $\sqrt{Y}$	.5210	1.073	1.441	1.674	2.345	2.813	3.417	4.133	5.130	5.203

**Remarks:**

1941 appeared as a low outlier and was deleted from the 60-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

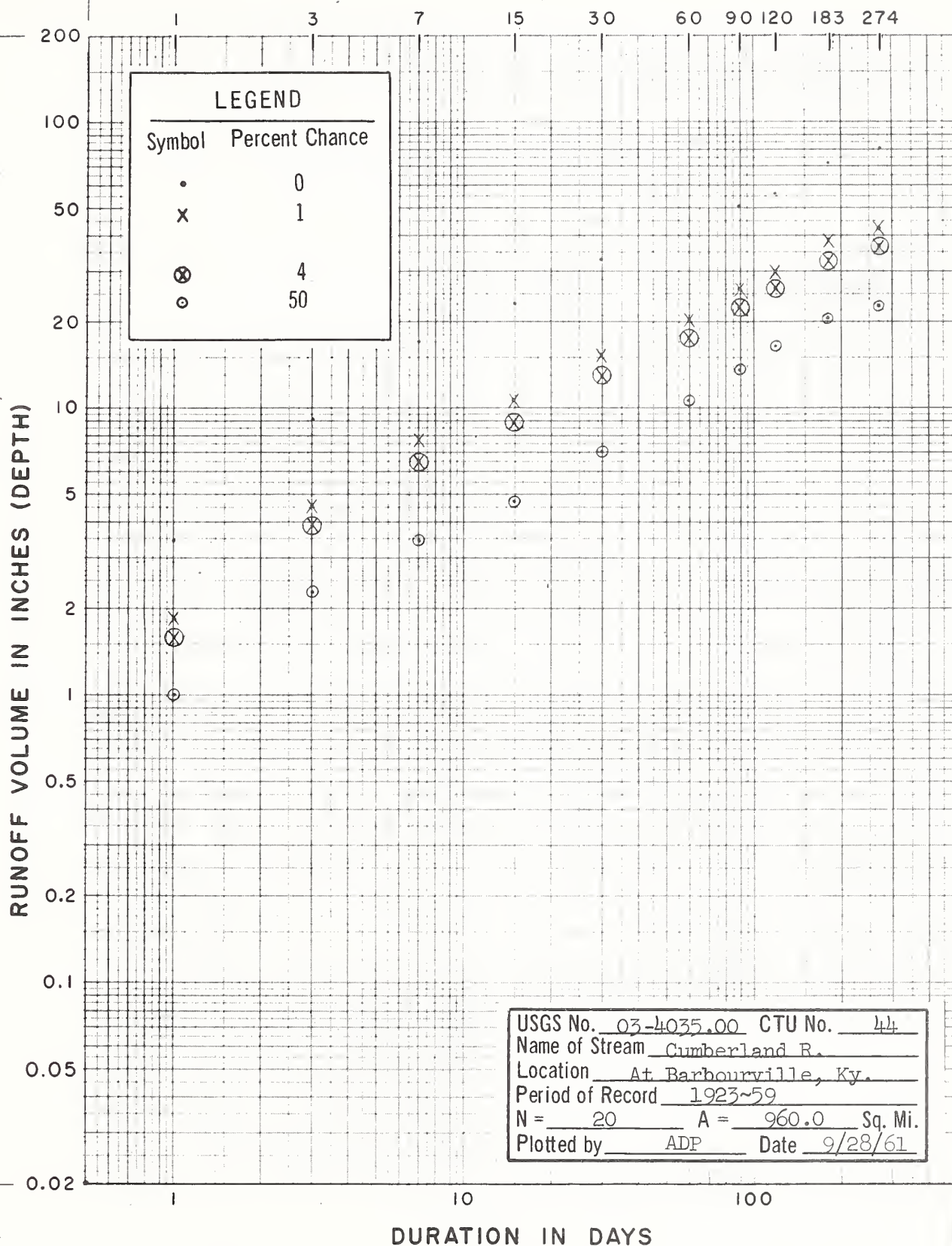
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Cumberland River      Gauge Location near Pineville, Kentucky  
 USGS No. 03-4030-00      CTU No. 43      Drainage Area 809.0 Sq. Mi.  
 Period of Record 1939-59      Date 9-7-61      N = 21 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.815	10.58	14.02	18.38	26.24	37.43	46.10	51.67	57.76	63.67
0.2	2.722	5.824	7.897	10.74	15.33	22.25	27.68	31.62	36.76	40.52
1	2.352	4.993	6.813	9.373	13.38	19.51	24.34	27.96	32.79	36.14
2	2.182	4.614	6.315	8.744	12.48	18.25	22.80	26.25	30.92	34.08
4	2.002	4.213	5.788	8.080	11.54	16.91	21.16	24.42	28.97	31.93
10	1.742	3.637	5.030	7.106	10.15	14.96	18.77	21.78	26.03	28.70
20	1.518	3.145	4.379	6.271	8.954	13.27	16.70	19.47	23.50	25.90
50	1.146	2.331	3.293	4.856	6.933	10.39	13.16	15.51	19.08	21.03
80	.839	1.671	2.402	3.670	5.240	7.966	10.16	12.14	15.27	16.83
95	.604	1.171	1.722	2.740	3.912	6.040	7.770	9.424	12.14	13.38
99	.445	.840	1.261	2.086	2.979	4.671	6.060	7.459	9.854	10.86
γ	8.346	7.495	8.153	10.25	10.17	11.18	11.74	12.91	15.54	15.53
β	.1424	.3276	.4195	.4909	.7034	.9565	1.150	1.229	1.252	1.381
β√γ	.4115	.8968	1.198	1.571	2.243	3.199	3.940	4.416	4.937	5.442

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-FLUORESCIBILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Cumberland River Gage Location at Barbourville, Kentucky  
 USGS No. 03-4035.00 CTU No. 44 Drainage Area 960.0 Sq. Mi.  
 Period of Record 1923-31, 1949-59 Date 9-8-61 N = 20 Years

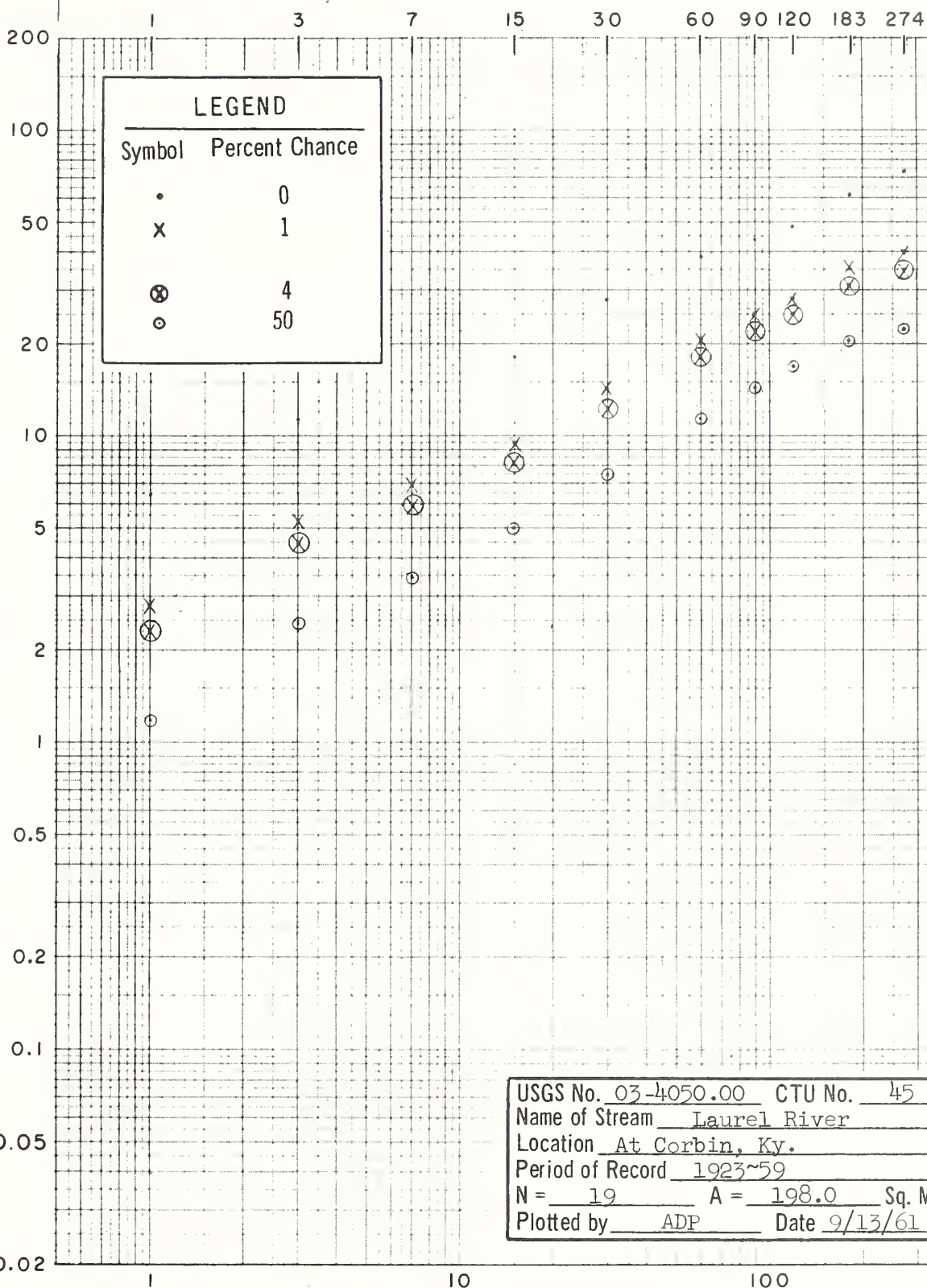
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	3.430	9.149	17.11	23.19	33.03	39.94	50.66	55.53	71.84	80.67
0.2	2.073	5.250	9.161	12.47	18.03	23.42	29.81	33.88	43.27	48.28
1	1.827	4.558	7.788	10.62	15.42	20.46	26.07	29.93	38.09	42.42
2	1.712	4.239	7.161	9.772	14.22	19.10	24.34	28.09	35.69	39.71
4	1.590	3.902	6.503	8.884	12.96	17.66	22.52	26.12	33.14	36.84
10	1.414	3.413	5.559	7.611	11.15	15.55	19.85	23.28	29.42	32.64
20	1.260	2.993	4.763	6.533	9.603	13.74	17.56	20.79	26.20	29.02
50	.996	2.287	3.451	4.758	7.056	10.66	13.67	16.54	20.69	22.82
80	.773	1.701	2.407	3.339	5.007	8.081	10.38	12.91	16.01	17.58
95	.594	1.246	1.634	2.280	3.468	6.056	7.807	10.00	12.27	13.40
99	.466	.932	1.130	1.592	2.455	4.626	5.984	7.902	9.597	10.43
$\gamma$	12.16	9.189	6.334	6.566	6.923	10.35	10.63	12.74	11.97	11.67
$\beta$	.0841	.2580	.5715	.7607	1.064	1.061	1.328	1.330	1.775	2.019
$\beta/\gamma$	.2932	.7820	1.438	1.949	2.799	3.414	4.330	4.746	6.140	6.895

Remarks:



RUNOFF VOLUME IN INCHES (DEPTH)



USGS No. 03-4050.00 CTU No. 45  
 Name of Stream Laurel River  
 Location At Corbin, Ky.  
 Period of Record 1923~59  
 N = 19 A = 198.0 Sq. Mi.  
 Plotted by ADP Date 9/13/61

DURATION IN DAYS

VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

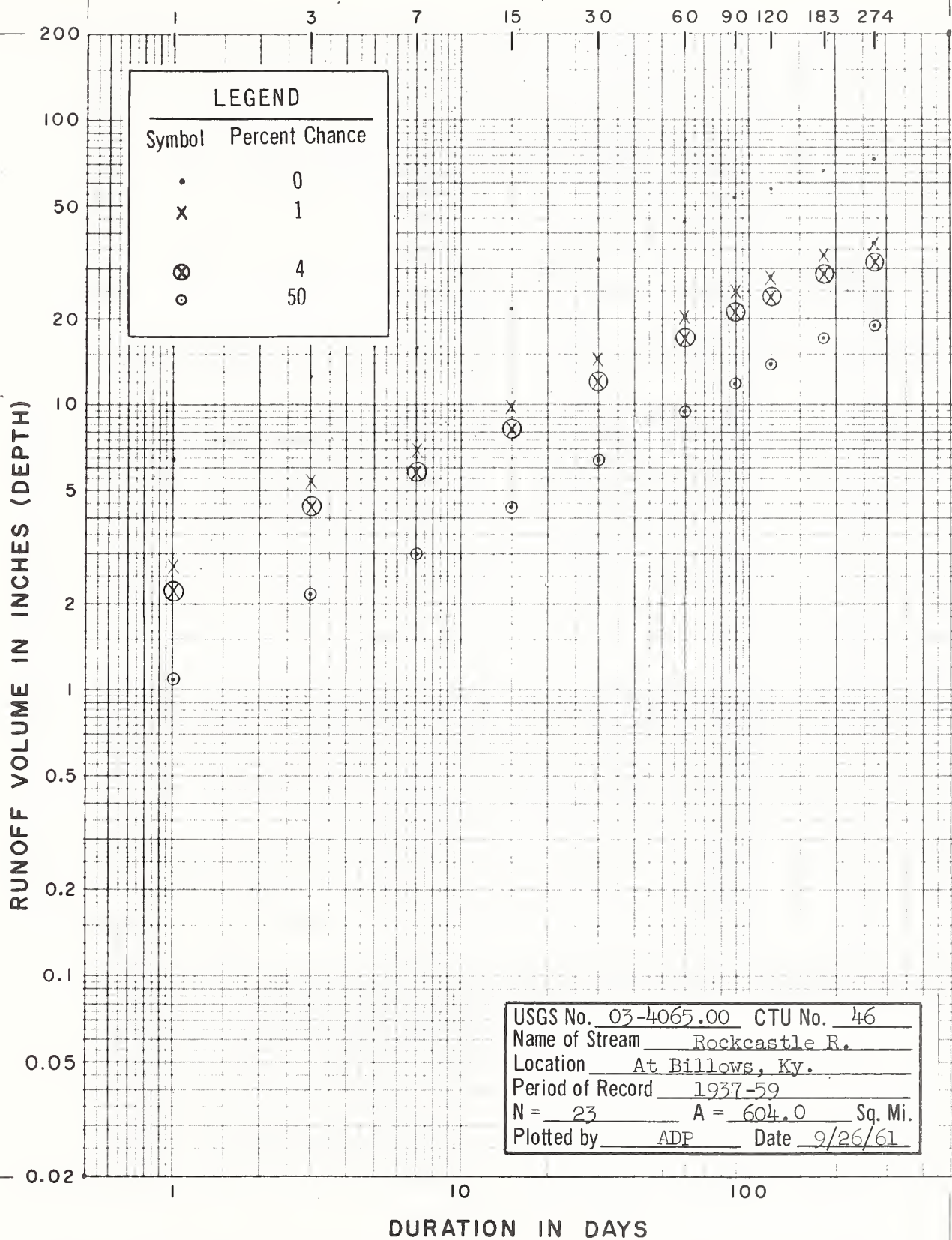
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Laurel River Gauge Location at Corbin, Kentucky  
 USGS No. 03-4050.00 CTU No. 45 Drainage Area 198.0 Sq. Mi.  
 Period of Record 1923-24, 1943-59 Date 8-31-61 N = 19 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.354	11.26	14.11	18.11	27.83	38.67	44.07	48.99	62.41	74.11
0.2	3.294	6.174	8.039	10.77	16.38	23.52	27.97	31.52	39.72	45.50
1	2.777	5.285	6.962	9.443	14.32	20.76	24.93	28.26	35.42	40.26
2	2.542	4.879	6.467	8.831	13.37	19.47	23.50	26.74	33.41	37.81
4	2.296	4.451	5.942	8.184	12.37	18.10	22.00	25.15	31.29	35.19
10	1.944	3.836	5.186	7.237	10.91	16.12	19.77	22.72	28.13	31.42
20	1.649	3.310	4.535	6.423	9.649	14.38	17.83	20.61	25.38	28.10
50	1.169	2.443	3.444	5.029	7.508	11.42	14.46	16.95	20.62	22.43
80	.793	1.743	2.542	3.855	5.705	8.897	11.56	13.75	16.50	17.58
95	.521	1.214	1.848	2.923	4.289	6.874	9.173	11.10	13.12	13.68
99	.348	.866	1.371	2.260	3.288	5.420	7.432	9.136	10.65	10.86
$\gamma$	5.605	7.178	8.751	11.27	10.67	12.58	15.42	17.56	15.54	13.26
$\beta$	.2218	.3562	.4076	.4610	.7281	.9319	.9592	.9825	1.353	1.739
$\beta/\gamma$	.5251	.9543	1.206	1.548	2.379	3.305	3.767	4.117	5.334	6.334

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

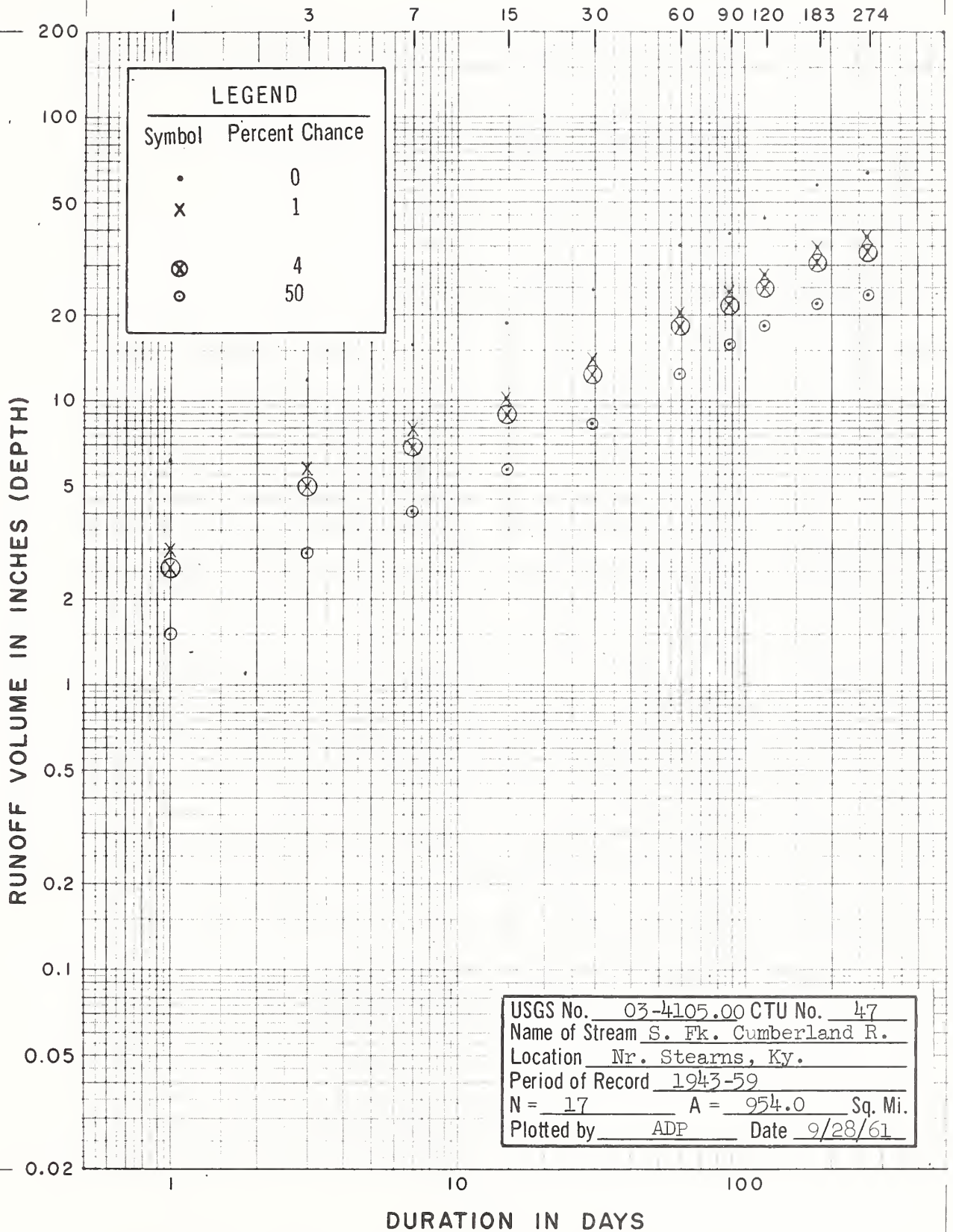
Name of Stream Rockcastle River at Billows, Kentucky  
 USGS No. 03-4065.00 CTU No. 46 Drainage Area 604.0 Sq. Mi.  
 Period of Record 1937-59 Date 9-6-61 N = 23 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.342	12.46	15.74	21.65	32.05	43.41	52.86	56.91	66.08	72.49
0.2	3.216	6.385	8.209	11.59	17.09	23.80	29.20	32.42	38.34	42.21
1	2.689	5.346	6.943	9.852	14.50	20.37	25.08	28.08	33.39	36.79
2	2.451	4.875	6.367	9.059	13.32	18.81	23.19	26.08	31.11	34.31
4	2.201	4.383	5.762	8.226	12.08	17.16	21.20	23.96	28.71	31.68
10	1.847	3.683	4.900	7.032	10.30	14.79	18.34	20.92	25.19	27.83
20	1.551	3.096	4.171	6.025	8.806	12.76	15.88	18.29	22.18	24.54
50	1.073	2.152	2.983	4.366	6.350	9.418	11.81	13.89	17.09	18.95
80	.706	1.422	2.046	3.045	4.400	6.718	8.508	10.25	12.83	14.28
95	.447	.905	1.361	2.066	2.962	4.680	5.999	7.452	9.511	10.62
99	.286	.584	.921	1.430	2.033	3.337	4.328	5.530	7.196	8.061
$\gamma$	4.855	4.986	5.925	6.411	6.279	7.214	7.612	8.808	9.785	10.00
$\beta$	.2359	.4613	.5343	.7183	1.075	1.370	1.624	1.639	1.806	1.959
$\beta/\gamma$	.5198	1.030	1.301	1.819	2.693	3.679	4.480	4.864	5.648	6.196

Remarks:





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

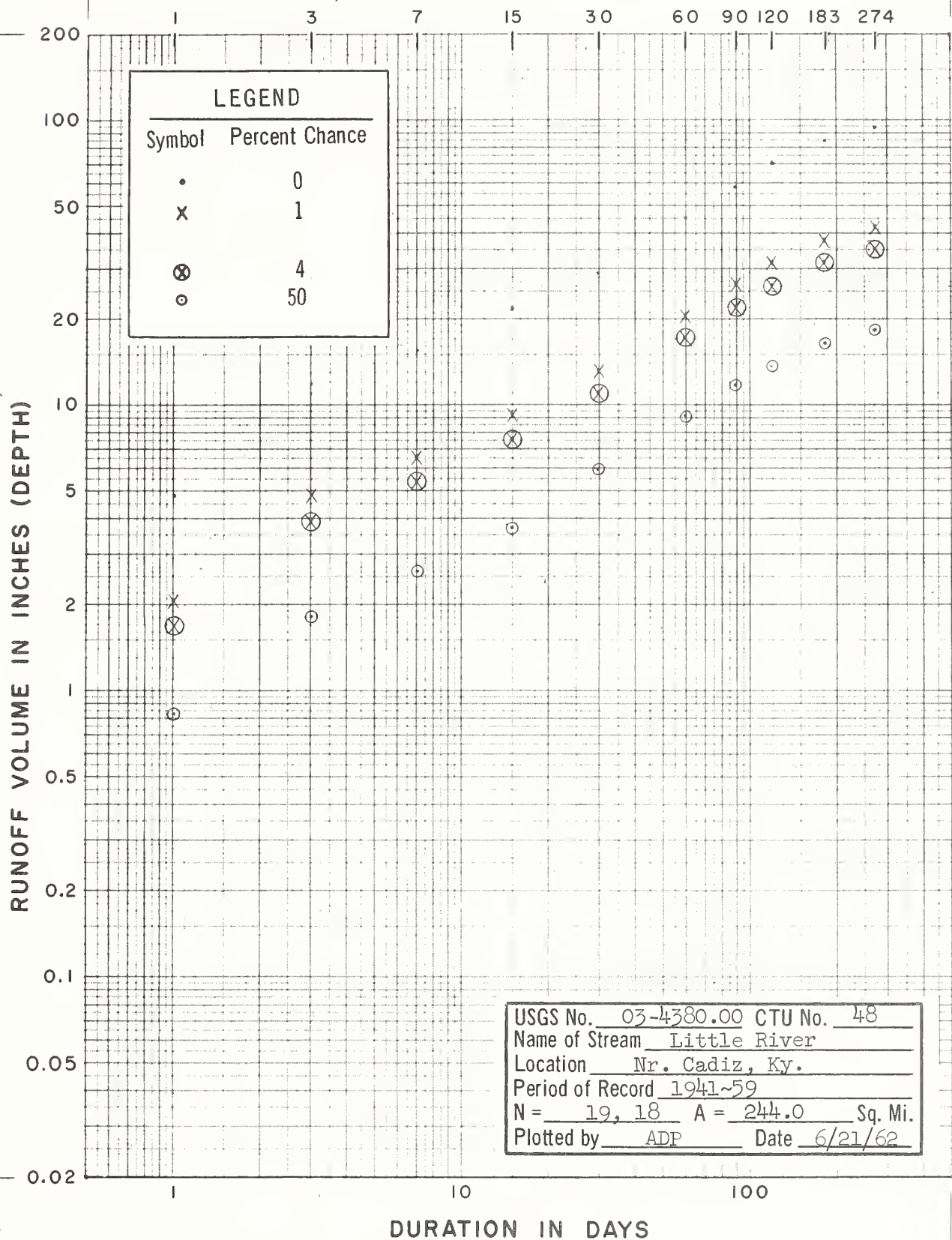
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream S. F. Cumberland River Gage Location near Stearns, Kentucky  
 USGS No. 03-4105.00 CTU No. 47 Drainage Area 954.0 Sq. Mi.  
 Period of Record 1943-59 Date 9-8-61 N = 17 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	6.090	11.81	15.70	18.74	24.47	35.16	38.79	43.94	57.60	63.34
0.2	3.482	6.750	9.142	11.54	15.66	22.79	26.57	30.34	38.37	41.85
1	3.019	5.853	7.969	10.22	14.01	20.50	24.23	27.74	34.78	37.83
2	2.807	5.441	7.431	9.604	13.23	19.43	23.13	26.51	33.08	35.94
4	2.581	5.004	6.862	8.942	12.42	18.29	21.95	25.19	31.26	33.91
10	2.255	4.372	6.028	7.989	11.19	16.58	20.19	23.22	28.57	30.90
20	1.975	3.828	5.314	7.153	10.13	15.08	18.63	21.47	26.19	28.25
50	1.504	2.916	4.104	5.719	8.279	12.48	15.87	18.38	22.01	23.62
80	1.115	2.161	3.092	4.492	6.674	10.20	13.39	15.60	18.31	19.52
95	.814	1.577	2.300	3.502	5.349	8.292	11.29	13.22	15.17	16.06
99	.606	1.175	1.746	2.784	4.372	6.883	9.694	11.41	12.83	13.50
$\gamma$	9.079	8.922	10.01	13.45	16.52	18.86	26.49	27.96	22.45	21.08
$\beta$	.1727	.3380	.4240	.4368	.5104	.6746	.6078	.6648	.7762	1.140
$\beta/\gamma$	.5205	1.009	1.342	1.602	2.074	2.930	3.128	3.515	4.721	5.235

Remarks:



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Little River Gage Location near Cadiz, Kentucky  
 USGS No. 03-4380.00 CTU No. 48 Drainage Area 244.0 Sq. Mi.  
 Period of Record 1941-59 Date 6-21-62 N = 19,18 Years

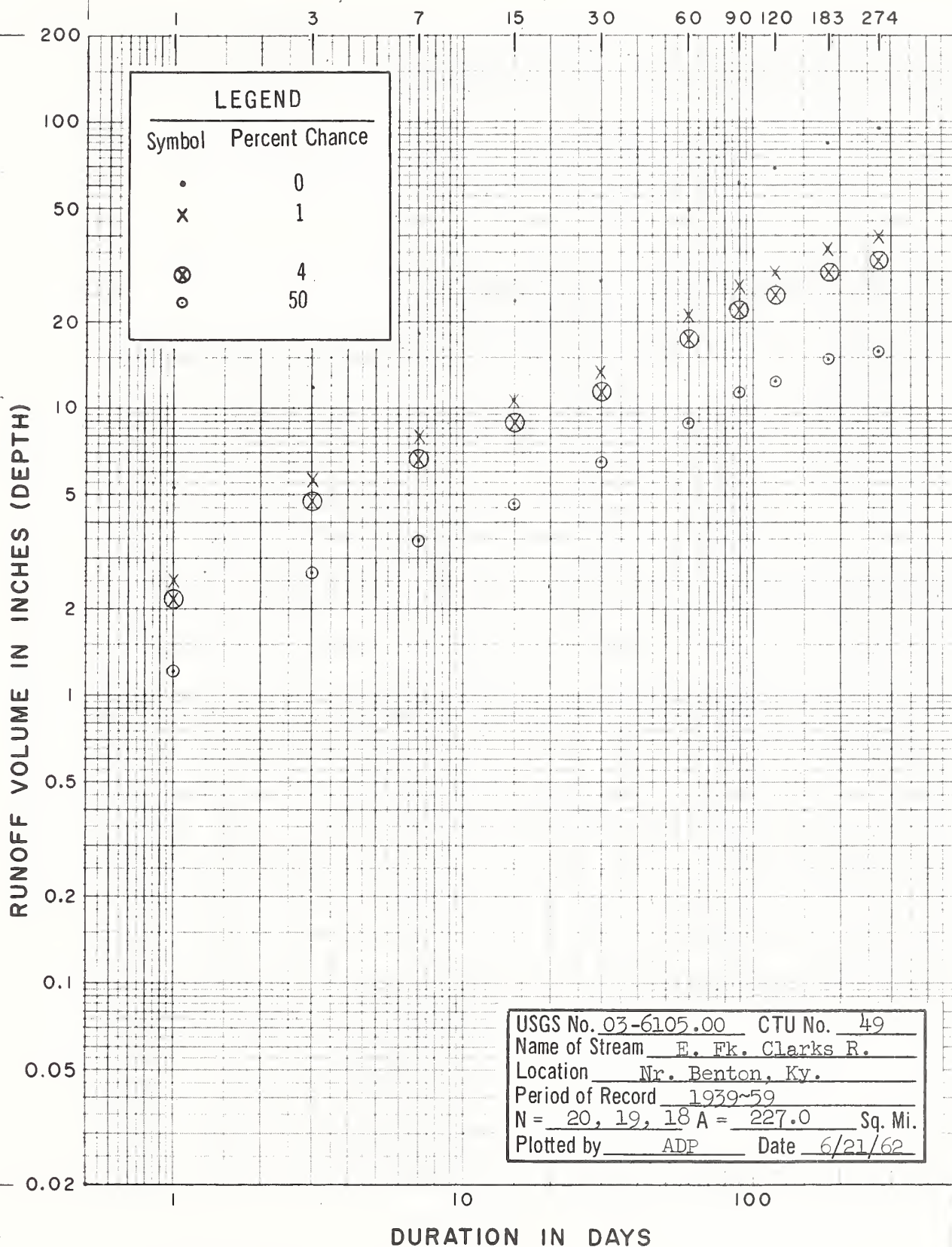
**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	4.727	11.71	15.37	21.44	28.76	45.18	58.12	70.07	84.28	93.85
0.2	2.422	5.815	7.796	10.98	15.46	24.19	31.11	37.22	44.77	49.86
1	2.028	4.815	6.518	9.197	13.16	20.56	26.45	31.52	37.91	42.22
2	1.849	4.364	5.941	8.387	12.12	18.91	24.32	28.92	34.78	38.73
4	1.662	3.894	5.336	7.540	11.01	17.17	22.08	26.19	31.50	35.08
10	1.397	3.230	4.478	6.337	9.436	14.68	18.88	22.29	26.81	29.86
20	1.174	2.676	3.759	5.327	8.100	12.57	16.17	19.01	22.86	25.46
50	.816	1.800	2.602	3.702	5.899	9.111	11.72	13.63	16.40	18.26
80	.540	1.140	1.712	2.447	4.260	6.355	8.175	9.386	11.29	12.57
95	.343	.688	1.084	1.558	2.827	4.313	5.548	6.265	7.535	8.391
99	.222	.417	.694	1.005	1.974	2.984	3.839	4.263	5.128	5.710
Y	5.010	4.155	4.904	4.972	6.529	6.323	6.366	6.052	6.086	6.087
B	.1746	.4672	.5692	.7945	.9457	1.510	1.936	2.393	2.871	3.196
B/V	.3907	.9523	1.260	1.772	2.416	3.796	4.884	5.888	7.082	7.886

**Remarks:**

1941 appeared as a low outlier and was deleted from the 30-274 day durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream E. F. Clarks River Gage Location near Benton, Kentucky

USGS No. 03-6105.00 CTU No. 49

Drainage Area 227.0 Sq. Mi.

Period of Record 1939~59

Date 6/2/62

N = 20,19,18 Years

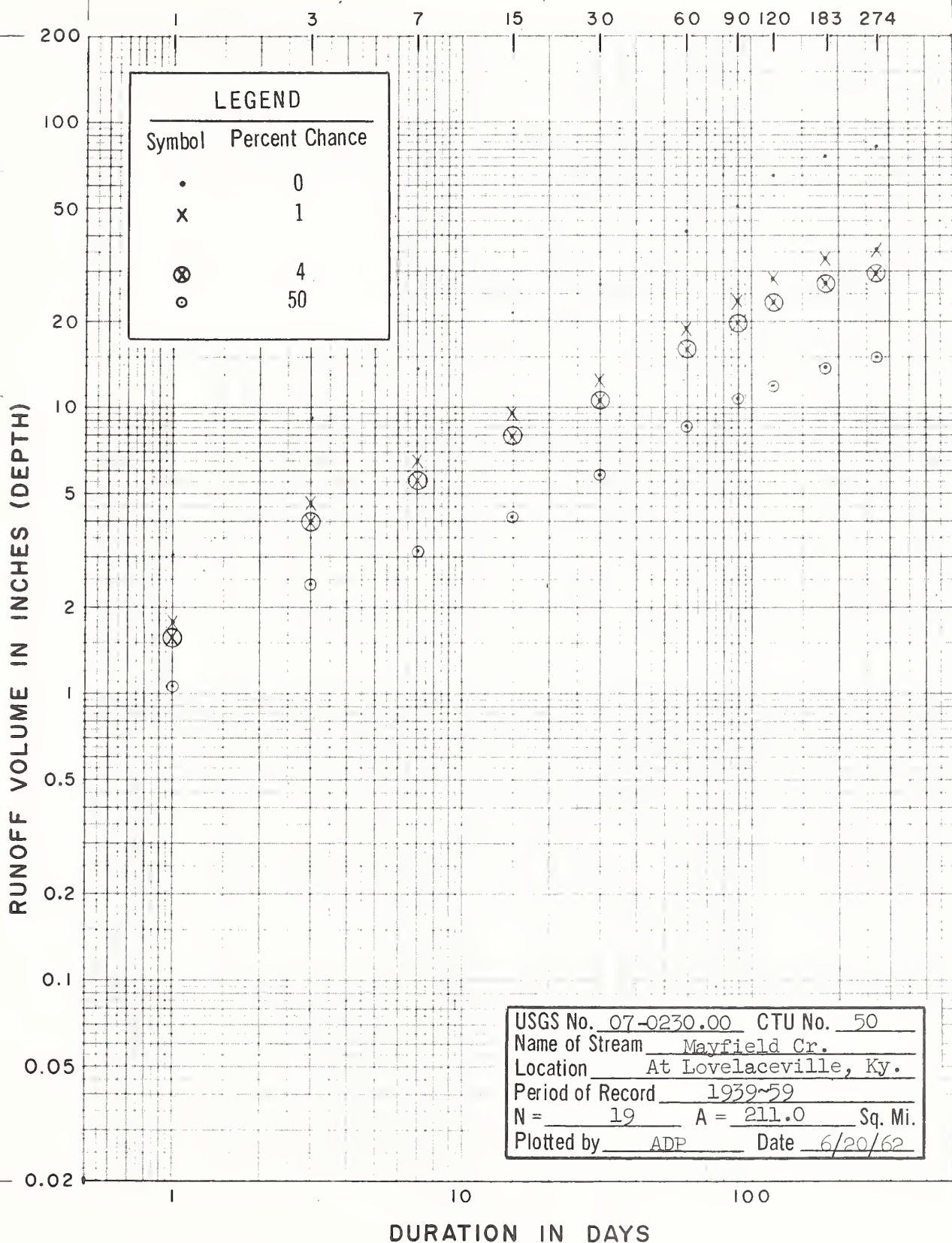
**Runoff Volume in Inches (Depth)**

% Probability (Greater than) \_\_\_\_\_ Duration in Days \_\_\_\_\_

	1	3	7	15	30	60	90	120	183	274
0.0	5.244	11.84	18.25	23.66	27.60	49.05	61.11	68.83	84.18	95.10
0.2	2.944	6.566	9.518	12.62	15.61	25.38	31.80	35.61	43.30	48.13
1	2.536	5.648	8.050	10.71	13.48	21.38	26.87	29.99	36.34	40.20
2	2.349	5.227	7.382	9.834	12.51	19.55	24.63	27.43	33.18	36.60
4	2.151	4.782	6.681	8.918	11.47	17.65	22.27	24.76	29.88	32.85
10	1.866	4.143	5.680	7.608	9.986	14.93	18.92	20.94	25.18	27.53
20	1.622	3.594	4.836	6.502	8.705	12.64	16.09	17.74	21.23	23.06
50	1.216	2.684	3.459	4.689	6.570	8.935	11.47	12.54	14.86	15.91
80	.883	1.942	2.373	3.249	4.812	6.036	7.839	8.470	9.914	10.42
95	.630	1.377	1.578	2.187	3.465	3.945	5.192	5.535	6.380	6.555
99	.459	1.000	1.068	1.501	2.550	2.619	3.500	3.675	4.167	4.170
γ	7.911	7.810	5.894	6.175	8.354	5.525	5.758	5.523	5.205	4.756
β	.1594	.3591	.6213	.8002	.8162	1.725	2.105	2.496	3.049	3.574
β/γ	.4482	1.003	1.508	1.988	2.359	4.054	5.051	5.688	6.957	7.795

Remarks:

1941 appeared as a low outlier and was deleted from all durations.  
 1954 appeared as a low outlier and was deleted from the 1-30 day durations.  
 1958 appeared as a high outlier and was deleted from the 1-day duration.



VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

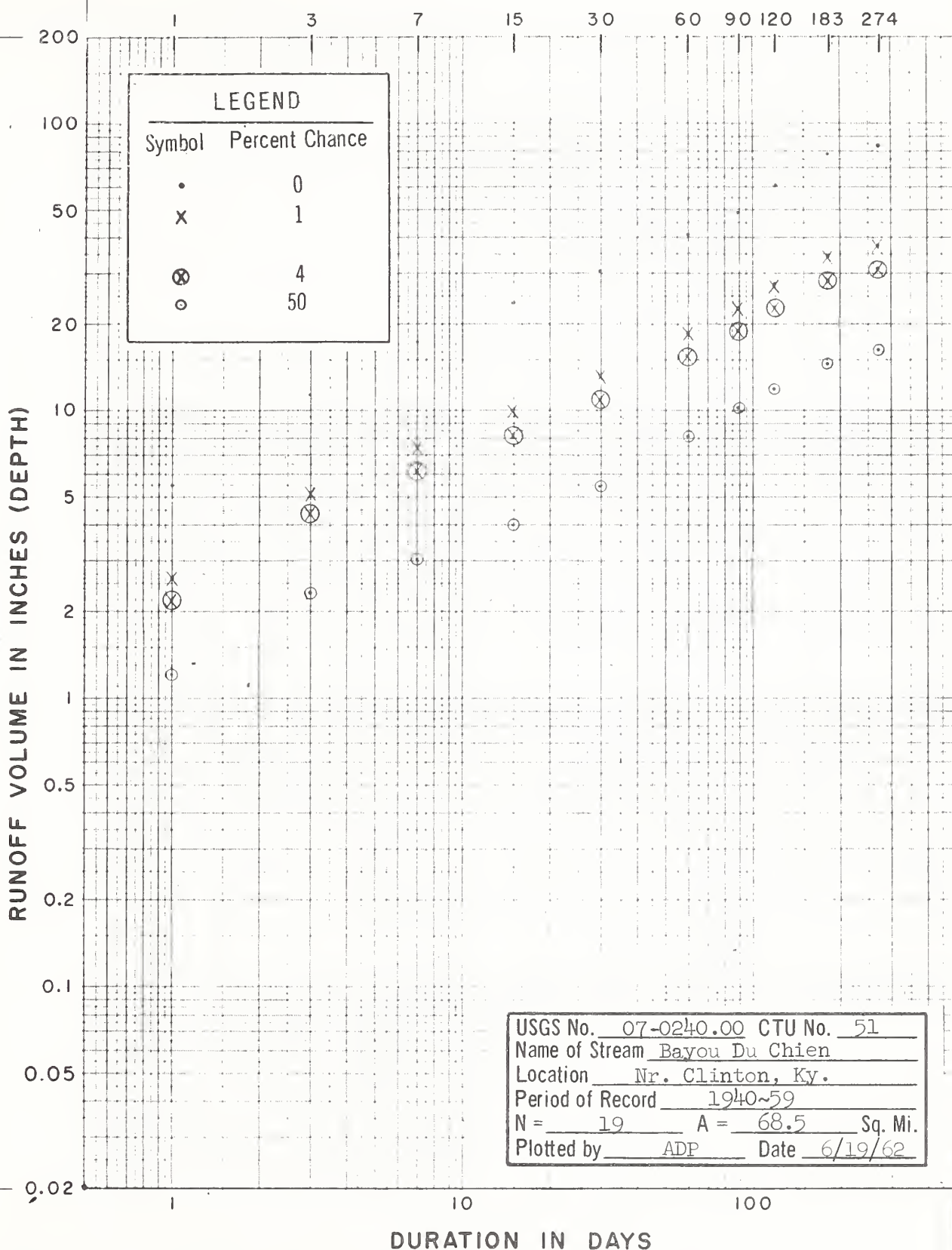
**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Mayfield Creek Gage Location at Lovelaceville, Kentucky  
 USGS No. 07-0230.00 CTU No. 50 Drainage Area 211.0 Sq. Mi.  
 Period of Record 1939-59 Date 6/2/62 N = 19 Years

% Probability (Greater than)	Runoff Volume in Inches (Depth)										Duration in Days			
	1	3	7	15	30	60	90	120	183	274				
0.0	3.024	9.140	13.57	21.29	26.78	41.22	50.39	64.70	75.91	81.73				
0.2	1.945	5.321	7.619	11.31	14.68	22.24	27.52	33.54	39.27	42.37				
1	1.745	4.638	6.563	9.577	12.57	18.97	23.52	28.28	33.08	35.72				
2	1.651	4.325	6.078	8.787	11.60	17.48	21.69	25.89	30.26	32.70				
4	1.552	3.994	5.566	7.958	10.58	15.91	19.77	23.38	27.31	29.53				
10	1.402	3.509	4.830	6.774	9.122	13.66	17.00	19.80	23.10	25.01				
20	1.272	3.093	4.197	5.775	7.871	11.75	14.65	16.80	19.57	21.22				
50	1.046	2.389	3.146	4.142	5.809	8.593	10.77	11.91	13.83	15.04				
80	.849	1.800	2.285	2.852	4.143	6.065	7.639	8.074	9.341	10.20				
95	.685	1.339	1.630	1.904	2.886	4.174	5.252	5.304	6.104	6.700				
99	.564	1.016	1.188	1.295	2.058	2.934	3.745	3.540	4.053	4.471				
$\gamma$	17.53	9.927	7.984	6.070	7.297	6.838	6.905	5.639	5.480	5.601				
$\beta$	.0607	.2479	.4105	.7262	.8400	1.325	1.625	2.252	2.709	2.854				
$\beta\sqrt{\gamma}$	.2541	.7812	1.160	1.789	2.269	3.464	4.270	5.347	6.274	6.754				

Remarks: 1941 and 1954 appeared as low outliers and were deleted from all durations.





VOLUME - DURATION - PROBABILITY CURVES ON AN ANNUAL BASIS

**VOLUME-DURATION-PROBABILITY ANALYSIS**  
(Two-Parameter Gamma Distribution)

Name of Stream Bayou Du Chien Gage Location near Clinton, Kentucky  
 USGS No. 07-0240.00 CTU No. 51 Drainage Area 68.5 Sq. Mi.  
 Period of Record 1940-59 Date 6/2/62 N = 19 Years

**Runoff Volume in Inches (Depth)**

% Probability (Greater than)	Duration in Days									
	1	3	7	15	30	60	90	120	183	274
0.0	5.454	11.31	17.25	23.61	30.55	41.02	49.15	61.39	78.94	83.75
0.2	3.002	6.077	8.875	11.97	15.75	21.88	26.51	32.62	40.93	44.49
1	2.574	5.176	7.449	10.01	13.23	18.56	22.62	27.62	34.51	37.67
2	2.378	4.764	6.802	9.124	12.09	17.05	20.84	25.34	31.58	34.56
4	2.171	4.331	6.125	8.195	10.90	15.46	18.97	22.95	28.52	31.31
10	1.875	3.711	5.161	6.877	9.191	13.19	16.29	19.53	24.16	26.65
20	1.621	3.185	4.352	5.772	7.762	11.27	14.01	16.65	20.49	22.72
50	1.201	2.319	3.046	3.996	5.451	8.128	10.25	11.94	14.53	16.29
80	.861	1.628	2.032	2.630	3.651	5.632	7.232	8.223	9.851	11.22
95	.604	1.112	1.308	1.664	2.363	3.792	4.977	5.489	6.472	7.488
99	.433	.776	.854	1.066	1.553	2.602	3.498	3.735	4.319	5.096
$\gamma$	7.313	6.501	5.201	4.878	5.273	6.154	6.772	6.008	5.579	6.025
$\beta$	.1709	.3727	.6254	.8760	1.100	1.389	1.587	2.105	2.762	2.867
$\beta/\gamma$	.4622	.9502	1.426	1.935	2.525	3.447	4.130	5.159	6.524	7.038

Remarks: 1941 appeared as a low outlier and was deleted from all durations.

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